Leelanau County, Michigan
Natural Hazard Mitigation Plan

2023

FEMA LETTER OF APPROVAL

ACKNOWLEDGEMENTS

The 2023 Leelanau County Natural Hazard Mitigation Plan is prepared for Leelanau County, Michigan and all the jurisdictions within it. This plan is the culmination of an interdisciplinary and interagency planning effort that required the participation, technical assistance and expertise of individuals within the agencies and organizations listed below. Refer to Appendix E for a table of how and when the representatives of each participating entity contributed to the development of the plan. Each jurisdiction is invited to be a continuing participant in future regular review and updates of the plan.

Community Representation	Organization	Representative	Title
Leelanau County	**Leelanau County**	Matt Ansorge	E.M./911 Director
		Kelly LaCross	E.M./911 Deputy Director
		Chet Janik	Administrator (former)
		Deborah Allen	Administrator (current)
		Ty Wessell	County BOC Chair (current)
		William Bunek	County BOC Chair (former)
		Rob Herman	GIS Analyst
		Trudy Galla	Planning & Community Development Director
		Lt. Jim Kiessel	Undersheriff
		Lt. Duane Wright	Law Enforcement Lieutenant
		April Missias	Leelanau County Senior Services Director
		Amber Weber	Building Official/Inspector
	Leelanau County Road Commission	Brendan Mullane	Managing Director
		Jim Calhoun	Board Member
		Tim Trudell	Fleet and Facilities Manager
Bingham Township	**Bingham Township**	Marian Werner	Supervisor
Centerville, Cleveland, Kasson and Solon Townships	**Cedar Area Fire and Rescue**	Andy Doornbos	Cedar Area Fire & Rescue, Fire Chief
Centerville Township	**Centerville Township**	Jim Schwantes	Supervisor
		Joe Mosher	Planning Commissioner
		Tim Johnson	Planning Commissioner
Cleveland Township	**Cleveland Township**	Tanelle Budd	Clerk
Elmwood Charter Township	**Elmwood Charter Township**	Jeff Shaw	Supervisor
	Elmwood Fire & Rescue	Keith Tampa	Elmwood Twp. Fire & Rescue, Fire Chief
Empire Township	**Empire Township**	Christine Neiswonger	Clerk
Glen Arbor Township	**Glen Arbor Township**	Tom Laureto	Supervisor
Kasson Township	**Kasson Township**	Dana Boomer	Clerk
		Chuck Schaeffer	Planning Commissioner; Chairman of Board of Review

Community Representation	Organization	Representative	Title
Leelanau Township	**Leelanau Township Fire and Rescue**	Hugh Cook	Fire Chief
Leland Township	**Leland Township**	Clint Mitchell	Planning Commissioner
	Leland Twp. Fire & Rescue	Dan Besson	Fire Chief
	Leland Public Schools	Stephanie Long	Superintendent
Solon Township	**Solon Township**	Stephen Yoder	Township Board Member
		Kelly Claar	Township Parks Committee Chair
Suttons Bay Township	**Suttons Bay Township**	Richard Bahle	Supervisor (former)
		Dorothy Petroskey	Treasurer
		Steve Patmore	Zoning Administrator
Suttons Bay Township, Bingham Township, Village of Suttons Bay	**Suttons Bay-Bingham Fire & Rescue**	Jim Porter	Suttons Bay-Bingham Fire & Rescue, Fire Chief
		Mark Bowen	Suttons Bay-Bingham Fire & Rescue, Captain
Village of Empire	**Village of Empire**	March Dye	Trustee
		Margaret Walton	Trustee
		Maggie Bacon	Trustee
		Derith Smith	Clerk
Village of Northport	**Village of Northport**	Hugh Cook	Trustee
		Daniel Caudill	Planning Commissioner
Village of Suttons Bay	**Village of Suttons Bay**	Char Fay	Clerk
Suttons Bay Township; Peshawbestown	**Grand Traverse Band of Ottawa and Chippewa Indians**	Jolanda Murphy	E.M./Public Safety
		Joe Huhn	DPW Director
		Nicki Basch	Housing Manager
		Lori Savaso	Risk Management
		Becky Oien	Tribal Manager
		Sandra Dunkin	Clinical Social Worker/Program Director
		Courtney Hessell	NRD Envtl. Specialist
		Garrett Fairchild	Fire Chief
Benzie County	**Benzie County**	Rebecca Hubers	Emergency Management Coordinator
Leelanau County	**Benzie-Leelanau District Health Department**	Chloe Willetts	Director of Personal Health
		Bobbi Scott	Emergency Preparedness Coordinator
	American Red Cross of Northern Michigan	Megan Powers	Disaster Program Manager
	Leelanau Conservancy	Gayle Egeler	Membership Coordinator
	Northwest Michigan Invasive Species Network	Audrey Menninga	ISN Coordinator
Leland Township	**Harbor Hill Fruit Farm**	Nick Florip	Farm Manager
Leelanau County	**Heartland Hospice**	Barb MacGregor	Administrator, RN, BSN

Community Representation	Organization	Representative	Title
City of Traverse City	**Traverse City Fire Department**	Jim Tuller	Fire Chief
	Mobile Medical Rescue	Amy Fairchild	Operations Manager
Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Village of Empire	**National Park Service - Sleeping Bear Dunes**	Andy Blake	Ranger
Leelanau County	**MI EGLE - RRD Cadillac District**	Brian Flickinger	Project Manager
	Michigan State Police	Lt. Frank Keck	Assistant District Commander
		Tpr. Jason Tropf	
		F/Lt. Travis House	Cadillac Post Commander
	Michigan State Police EMHSD	Lt. Michael deCastro	Michigan Critical Incident Management System Trainer

Prepared for: Leelanau County Board of Commissioners
Prepared by: Leelanau County Office of Emergency Management with assistance from:

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I. INTRODUCTION

Hazard mitigation is defined as any action taken before, during, or after a disaster or emergency to permanently eliminate or reduce the long-term risk to human life and property from natural, technological and human-related hazards. Mitigation is an essential element of emergency management, along with preparedness, response and recovery.

Mitigation allows repairs and reconstruction to be completed after an incident occurs in such a way that does not just restore the damaged property as quickly as possible to pre-disaster conditions. It also ensures that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage. When successful, hazard mitigation will lessen the impact of a disaster on people, property, the environment and economy, and continuity of services through the coordination of available resources, programs, initiatives, and authorities.

A *hazard*, in the context of this plan, is an event or physical condition that has potential to cause fatalities; injuries; damage to personal property, infrastructure, or the environment; agricultural product loss; or interruption of business or civic life. The Leelanau County Natural Hazard Mitigation Plan focuses on *natural* hazards such as extreme heat, drought, wildfires, flooding, shoreline erosion, dangerous shoreline currents, thunderstorms, high winds, hail, tornadoes, extreme winter weather, and invasive species. An exception is that it will also consider these technological and human-related hazards: dam failure and public illness outbreak. The following natural hazards were not included in the analysis for this Hazard Mitigation Plan: earthquakes, space weather, and subsidence. According to information presented about these hazards in Michigan State Police's *2019 Michigan Hazard Analysis*, there is are very little risk of these events occurring in the Northwest Michigan area.

The main objective of the Leelanau County Natural Hazard Mitigation Plan is to permanently eliminate or reduce long-term risks to people and property from natural hazards so that county assets such as transportation, infrastructure, commerce, and tourism can be sustained and strengthened. This can be accomplished through collaborative efforts/activities amongst agencies within the county to protect the health, safety, and economic interests of the residents and businesses through planning, awareness, and implementation.

Through this Plan, a broad perspective was taken in examining multiple natural hazard mitigation activities and opportunities in Leelanau County. Each hazard was analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigation.

Since the 2016 plan's adoption period, the county and municipalities have achieved the following key endeavors to address their priority mitigation strategy areas:

- Public and private coordination for shoreline flooding and erosion mitigation
- Utilities perform emergency and preventative tree work
- Leelanau Conservancy acquisition of land for open space designation

Appendix C provides a list of mitigation strategies included in the Leelanau County 2016 Natural Hazards Mitigation Plan, along with their current status and how they may have been integrated into other local planning mechanisms.

Section VII of this plan, "Mitigation Strategies and Priorities", provides a current list of hazard mitigation strategies for each natural hazard identified. Mitigation strategies were developed based on discussions with local officials and a review of FEMA/MSP best practices for hazard mitigation. (Refer to Appendix D for a list of Alternative Strategies that were considered.) Strategies are grouped according to their purpose: Awareness and Preparation; Shelters; Buildings & Infrastructure; Utilities & Technology; and Environment & Natural Resources. The strategies table also includes: a description of each strategy; what hazards it addresses; where the strategy applies; who is responsible for implementing the strategy; how the strategy will be implemented (what resources are available to apply the strategy); the estimated timeframe for completion; the level of priority; and what type of strategy it is. Most strategies are intended to be action items completed during the 5-year timeframe in which the plan is active. Some long-term strategies may extend beyond the 5-year timeframe due to feasibility or level of difficulty.

Recognizing the importance of reducing community vulnerability to natural hazards, Leelanau County is actively addressing the issue through the development and implementation of this plan. This process will help ensure that Leelanau County remains a vibrant, safe, enjoyable place in which to live, raise a family, continue to conduct business, and maintain a tourist base. The Plan serves as the foundation for natural hazard mitigation activities and actions within

Leelanau County, and will be a resource for building coordination and cooperation within the community for local control of future mitigation and community preparedness around the following goals:

Goal 1: Increase whole community participation, strategies, and initiatives in natural hazardsmitigation
Goal 2: Integrate hazard mitigation considerations into the community'scomprehensive planning process
Goal 3: Utilize available resources and apply for additional funding for natural hazards mitigation projects
Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

II. PLANNING PROCESS

The Stafford Act, as amended by the Disaster Mitigation Act of 2000, shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is referred to as hazard mitigation planning. FEMA requires government entities to have a natural hazards mitigation plan in place and updated on a 5-year cycle as a condition for applying for grant funding related to natural hazard mitigation and remediation. Leelanau County has a history of mitigation planning and adopted past Natural Hazard Mitigation Plans in 2007 and 2016. The adoption of the 2023 plan will reaffirm the eligibility of the county, as well as those local municipalities who participated in the planning process and adopted the county's plan, for federal funding.

The update of the County's plan was led by the Natural Hazards Task Force composed of the County's Local Planning Team (LPT), organized by the Leelanau County Department of Emergency Management. Team members consist of first responders and local, regional, and state public entities that ensure the readiness of County entities by recommending equipment purchases, training and exercises, and public education on preparedness issues. Networks Northwest staff assisted with the creation of the updated plan by providing meeting facilitation, conducting an online survey, and writing the plan. The Task Force generally met every two months, in-person, at the Leelanau County Government Center in Suttons Bay Township. All meetings were open to the public.

Invitations to participate in the planning process - via email invitation, phone calls, meeting attendance/presentation, or mailed letters - were sent to the following stakeholders: local and regional agencies involved in hazard mitigation activities; agencies that have the authority to regulate development; neighboring communities; representatives of businesses, academia, or other private organizations; and representatives of nonprofit organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations. Please refer to the Acknowledgements section in the beginning of this plan for a list of participants; Appendix E for a detailed table showing how and when representatives participated in the planning process; and Appendix F for meeting and public input documentation. All jurisdictions in Leelanau County remain as continuing participants in the 2023 Hazard Mitigation Plan (since the 2016 plan was completed).

The following is an outline of events for the development of the 2023 Leelanau County Natural Hazard Mitigation Plan:

- On July 1, 2021, Matt Ansorge (County Emergency Manager/911 Director) attended a project kick-off meeting with other regional county and tribal emergency managers.

- An online public survey was made available from October 4, 2021 to February 4, 2022 to obtain input on community experience, concerns and priorities regarding natural hazard mitigation in Leelanau County. Table 1 indicates the representatives of organizations that participated in the survey. A copy of the survey results are included in Appendix B.

Table 1. Community Survey Participation

Community/Organization	Representative (if indicated in survey)
Bingham Township	Marian Werner, Supervisor
Centerville Township	Jim Schwantes, Supervisor;
Cleveland Township	Tanelle Budd, Clerk
Elmwood Charter Township	Jeff Shaw, Supervisor
Glen Arbor Township	Tom Laureto, Supervisor
Kasson Township	Chuck Schaeffer, Planning Commissioner/Board of Review; Dana Boomer, Clerk
Leland Township	Dan Besson, Fire Chief,
Solon Township	Kelly Claar, Parks Committee Chair; Stephen Yoder, Trustee
Suttons Bay Township	Rich Bahle (former Supervisor); Steve Patmore, Zoning Administrator; Dorothy Petroskey, Treasurer
Village of Empire	Derith Smith, Clerk; Maggie Bacon, Trustee
Village of Northport	Daniel Caudill, Planning Commissioner
Village of Suttons Bay	Char Fay, Clerk;
City of Traverse City	Jim Tuller, Fire Chief
Grand Traverse Band of Ottawa and Chippewa Indians	Jolanda Murphy, Tribal Emergency Manager and County LPT Tribal Liason
Benzie-Leelanau Health Department	Bobbi Scott, Emergency Preparedness Coordinator; Chloe Willets, Director of Personal Health
Leelanau County Sheriff's Office	Undersheriff
Leelanau County Road Commission	Brendan Mullane, Managing Director; Tim Trudell, Fleet and Facilities Manager
Leelanau County Department of Building Safety	Amber Weber, Building Official
Leelanau County Planning Department	Trudy Galla, Planning Director
Leelanau County Emergency Management/911	Matt Ansorge, Director and Kelly LaCross, Deputy Director
The Leelanau Conservancy	Gayle Egeler, Membership Coordinator
Heartland Hospice	Barb MacGregor, Administrator
Michigan State Police	Assistant Post Commander
American Red Cross	Meghan Powers, Disaster Program Manager
Leland Public Schools	Stephanie Long, Superintendent

- LPT meetings where the Natural Hazards Mitigation Plan update work was discussed:
  - On October 21, 2021 Networks Northwest provided an introduction and timeline for the project, and presented the community profile information.
  - December 9, 2021
  - On February 10, 2022 Networks Northwest presented the hazard analysis and provided a summary of survey results.
  - October 13, 2022
  - On December 8, 2022 Networks Northwest presented the partial draft plan, goals and objectives, and hazard mitigation strategies.
  - On February 9, 2023 Networks Northwest presented the final draft plan and strategies table
  - On April 13, 2023 Networks Northwest presented the final draft maps and plan as part of the public hearing for the plan during the LPT meeting.

- On April 14, 2022 a joint community meeting was held between GTB Tribal officials and representatives from Leelanau County to discuss potential hazards. The meeting was held at the Leelanau County Government Center.

During development of the plan, all Leelanau County municipalities were provided the opportunity to participate in the online community survey, participate in scheduled meetings, and comment on draft plan materials. Additionally, representatives from county and regional agencies that encompass or share borders with Leelanau County (listed below) were invited to participate in the planning meetings, and were able to view the draft and final plan materials on the hazard mitigation project page of Network Northwest's website.

- Gregg Bird, Emergency Management Coordinator, Grand Traverse County
- Jolanda Murphy, Public Safety Department 2 Manager and Emergency Manager, Grand Traverse Band of Ottawa and Chippewa Indians
- Rebecca Hubers, Emergency Management Coordinator, Benzie County
- Robert Carson, Regional Director of Community Development, Networks Northwest

The draft plan was published openly on the Leelanau County Emergency Management webpage, as well as the project page on Networks Northwest's website. The public was encouraged to review the draft plan and invited to submit suggestions and ideas for updates, changes to be considered during updates. All meetings where the plan was discussed were openly published for public and other jurisdiction/municipality participation as well. No formal written comments were received.

In March of 2023, Networks Northwest e-mailed, and mailed via certified mail, a letter to all local government offices in Leelanau County. The letter provided notification of the public hearing on the draft plan, a website address to access the plan, and requested local government review and feedback.

Additionally, the public was notified through a direct mailing and a published notice in the *Leelanau Enterprise* on March 23, 2023 that the County's draft Natural Hazard Mitigation Plan and the opportunity to provide feedback at the public hearing held on April 13, 2023 at the Leelanau County Local Planning Team meeting. Following the public hearing, Committee members recommended the draft plan be submitted to Michigan State Police and FEMA for their review and approval.

Below are images of the websites for the available draft plan and a copy of the published notice to the public.

Figure 1. Public Meeting Notice in the Leelanau Enterprise Newspaper

NOTICE OF AVAILABILITY OF DRAFT HAZARD MITIGATION PLAN and Public Meeting for Input on the Draft Hazard Mitigation Plan

Leelanau County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000.

A public meeting will be conducted following the public review period beginning at 12 Noon on Thursday, April 13, 2023, in the Community Meeting Room of the Leelanau County Government Center, 8527 E. Government Center Dr., Suttons Bay Michigan.

Public comments can be submitted as follows:

- In person, or by representative at the public meeting.
- Forwarded to Networks Northwest, PO Box 506, Traverse City MI 49685,
- Or by email to Jennifer.neal@networksnorthwest.org

The draft plan is available for review on Leelanau County's website, www.leelanau.gov and on the Network Northwest website, https://www.networksnorthwest.org/

Leelanau County will provide necessary reasonable auxiliary aids and services, such as signers for the hearing impaired and audiotapes of printed materials being considered at the meeting, to individuals with disabilities upon twenty-four (24) hours' notice to Leelanau County. Individuals with disabilities requiring auxiliary aids or services should contact the Leelanau County Clerk by calling as follows:

Michelle L. Crocker
Leelanau County Clerk 231/256-9824

Affidavit of Publication

Leelanau County Administrator
Description: Draft Hazard Mitigation Plan

John T. Elchert being first duly sworn, says that he is the publisher of The Leelanau Enterprise, a newspaper published in the English language for the dissemination of local or transmitted news and intelligence of a general character and legal news, which is a duly qualified newspaper, and that annexed hereto is a copy of a certain order taken from said newspaper, in which the order was published:

Leelanau Enterprise: 3/23/2023

Signed: _____
John T. Elchert, Publisher

Subscribed and sworn to before this date 3/23/2023

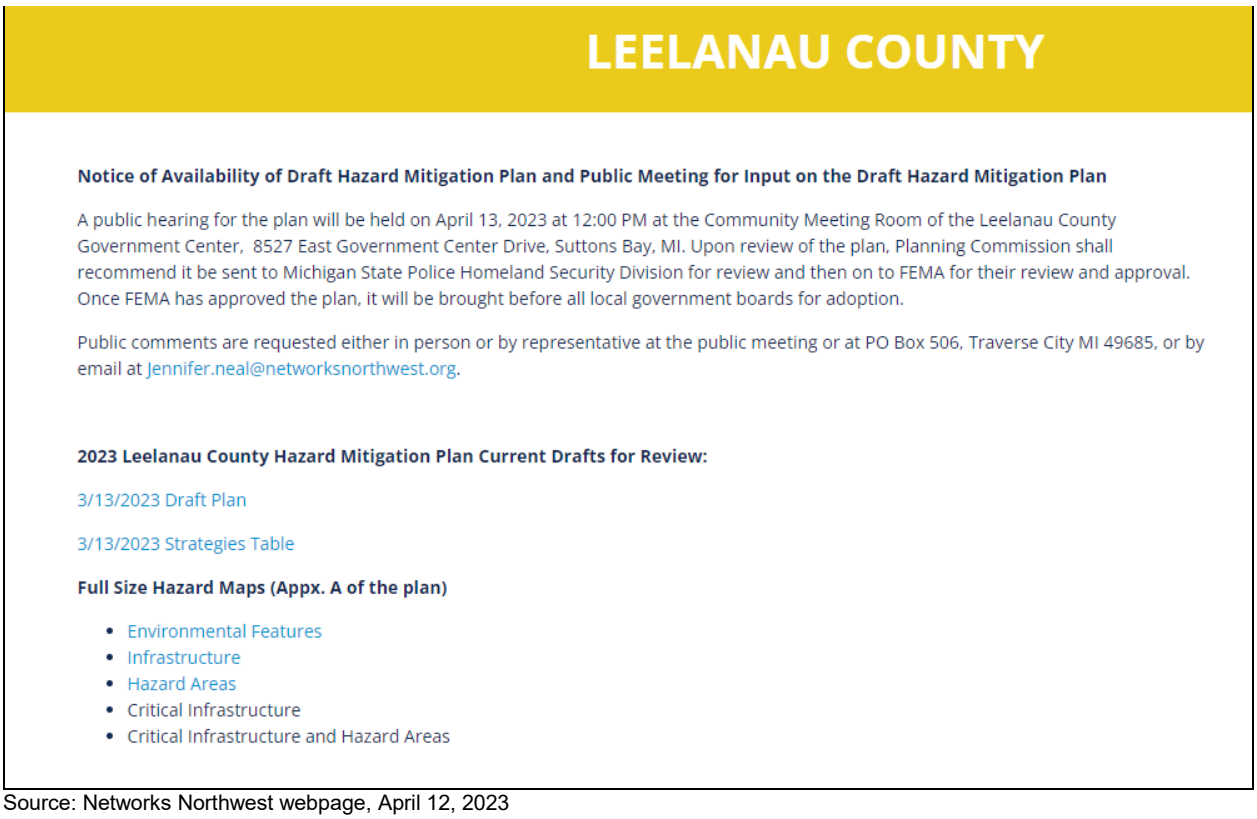
Patrice Korson

Patrice Korson
Notary Public, Leelanau County, Michigan
Acting in Leelanau County

My Commission Expires April 1, 2028

Source: *Leelanau Enterprise* on March 23, 2023

Figure 2. Networks Northwest's Webpage for the Leelanau County Hazard Mitigation Plan



LEELANAU COUNTY

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for Input on the Draft Hazard Mitigation Plan

A public hearing for the plan will be held on April 13, 2023 at 12:00 PM at the Community Meeting Room of the Leelanau County Government Center, 8527 East Government Center Drive, Suttons Bay, MI. Upon review of the plan, Planning Commission shall recommend it be sent to Michigan State Police Homeland Security Division for review and then on to FEMA for their review and approval. Once FEMA has approved the plan, it will be brought before all local government boards for adoption.

Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City MI 49685, or by email at Jennifer.neal@networksnorthwest.org.

2023 Leelanau County Hazard Mitigation Plan Current Drafts for Review:

3/13/2023 Draft Plan

3/13/2023 Strategies Table

Full Size Hazard Maps (Appx. A of the plan)

- Environmental Features
- Infrastructure
- Hazard Areas
- Critical Infrastructure
- Critical Infrastructure and Hazard Areas

Source: Networks Northwest webpage, April 12, 2023

III. COMMUNITY PROFILE

Land Use/ Land Cover

Leelanau County is located in Northwest Lower Michigan, and is bordered by Lake Michigan to the north and west, the West Arm of Grand Traverse Bay to the east, and Grand Traverse County and Benzie County to the south. North Manitou Island (part of Leland Township) and South Manitou Island (part of Glen Arbor Township.) are located west of the mainland in Lake Michigan. Leelanau Township also includes two offshore islands, South Fox Island and North Fox Island, located 15-20 miles northwest of the mainland.

Including the area of Lake Michigan within its jurisdiction, Leelanau County is a total 2,532.38 square miles or 1,620,723.2 acres in area. Approximately 347.20 square miles are land area, and 86% of the county area, or 2,183.91 square miles, is water. Additionally, the county has 151 miles of Lake Michigan shoreline. Excluding the area of Lake Michigan, the County has a total of 240,523 acres (Table 2). Land cover in Leelanau County is a checkerboard of woodlots, pastures or meadows, active crop fields, orchards and water. There are few routes where forest borders the roads for more than a half mile, nor where open fields stretch for more than a mile without encountering another woodlot. There is more wooded landscape than open fields. The predominant land cover type is "Forested," a combination of deciduous forest, evergreen forest, and mixed forest (Table 2). The second most prevalent land cover type is "Agriculture," a combination of cultivated crops and hay/pasture lands. Agricultural lands depicted on a future land use map for the county (Figure 3) include central County farms, ridge-top farms, and orchards.

Table 2. Land Cover by Type

Classification	Acres	Percent
Developed, High Intensity	141.39	0.06%
Developed, Low Intensity	7,011.56	2.92%
Developed, Medium Intensity	762.60	0.32%
Developed, Open Space	9,980.24	4.15%
Agriculture (Cultivated Crops and Hay/Pasture)	42,423.31	17.64%
Forested (Deciduous, Evergreen and Mixed Forest)	105,084.07	43.69%
Wetlands (Emergent Herbaceous and Woody Wetlands)	18,550.13	7.71%
Herbaceous, Shrub/Scrub	30,295.98	12.60%
Open Water (does not include Lake Michigan)	18,573.95	7.72%
Barren Land	7,699.99	3.20%
TOTAL	**240,523.22**	**100.00%**

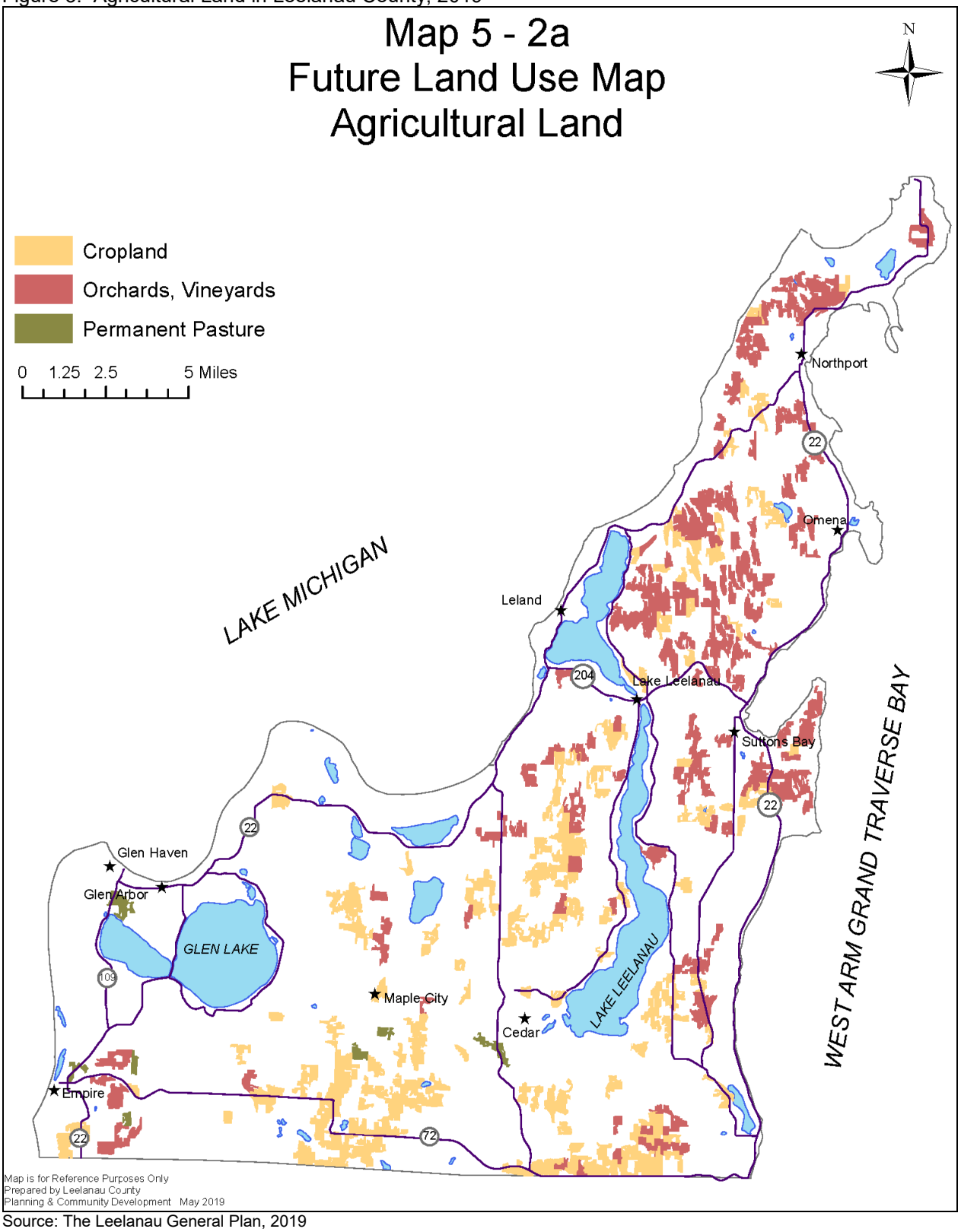
Source: Networks Northwest

The 1995 *Leelanau General Plan*, last amended in 2019, describes the major land features of the county as high dune and glacial ridges, which generally run north to south. There are small pocket valleys between the ridges, as well as broad slightly rolling plateaus in the center of the county. High points on the ridges are landmarks because of the striking views they provide to the inland lakes, Lake Michigan, and Grand Traverse Bay. Big and Little Glen Lakes and Lake Leelanau are the largest lakes in the county. Numerous smaller lakes and streams, usually associated with wetlands, are scattered throughout the county. The area north of Northport is flat compared to the rest of the county, with large open fields and large conifer plantations. Sleeping Bear Dunes National Lakeshore is located along the southwest coast of the county, near Empire, and includes the North and South Manitou Islands. The National Lakeshore extends south into adjoining Benzie County. Figure 1 is a map of agricultural lands in the county as of 2019. Every community in the county, except for the Villages of Suttons Bay and Northport, and the City of Traverse City, have some form of agricultural land use (cropland, orchards/vineyards, or permanent pasture).

According to the 2017 Census of Agriculture, the county had 50,053 acres of land in farms for a total of 470 farms. This represents a 5% and 16% drop in the number of farms and acreage of farms, respectively, since the 2012 USDA Census of Agriculture. About 93.7% of the market value of agricultural products sold in the county is from crops. Fruits, tree nuts, and berries had the highest market value of agriculture products sold at $35,292,000. Leelanau County ranks 5th in the State of Michigan for the sale of fruits, tree nuts, and berries overall.

Developed land cover is found predominantly in and around the city, townships, and villages in southeast and east Leelanau County. The City of Traverse City crosses the Leelanau-Grand Traverse County line north into Leelanau County and development extends into Elmwood Township, along state highway M-22, into Bingham Township, Suttons Bay Township, the Village of Suttons Bay, and Peshawbestown (Figure 4). Due to close proximity to commercial centers in Grand Traverse County, downtown Traverse City and Garfield Township, areas within a manageable commute-time in Leelanau County will continue to develop. New development will largely be residential, support services, and agri-business or agri-tourism.

Figure 3. Agricultural Land in Leelanau County, 2019



Source: The Leelanau General Plan, 2019

The 2016 Hazard Mitigation Plan indicated that 126,900 acres of the county was composed of forested lands. Based on the 2023 land cover data, there has been a decrease in forested areas by 21,815 acres, or 17.2 percent. While development in the county has remained fairly steady in the past decade, it has been noted that the type of new development is changing. Office and industrial development has largely stopped, commercial development has slowed, but residential development is occurring as quickly as plans can be approved. Housing of all types and prices is in demand, but many communities desire smaller units and multiple family units. This type of housing is especially important for the senior population and will likely be in demand for many years. The Environmental Features Map in Appendix A shows the intensity of development in the county as well as natural features.

Population

Leelanau County is the 7th most populated county in the ten county region of Northwest Lower Michigan (Table 3) and is the ranked 63 out of 83 counties in the state for population.[1] The 2019 American Community Survey (ACS) estimated the county population to be 21,652 people. A comparison of the 2010 and 2019 ACS data indicates a 0.5% decrease in county population from 2010, when the population was an estimated 21,757 persons (Table 4). The estimated 2019 population per square mile is approximately 11.1 people.

Leelanau County is composed of eleven (11) townships, three (3) villages, and the northern part of the City of Traverse City. The communities of Suttons Bay Township, Bingham Township, Leland Township, Kasson Township, and Glen Arbor Township experienced population decline between 2010 and 2019 (Table 4). The most populated community is Elmwood Charter Township, located in the southeast portion of the county, with an estimated 4,497 persons (Figure 3). The population estimates for the villages are shown separately for informational purposes; however, those population count estimates are incorporated into the totals presented for the township in which they are located. The second most populated community, at an estimated 2,985 persons is Suttons Bay Township, which contains the Village of Suttons Bay. The third most populated community is Bingham Township, at 2,496 persons.

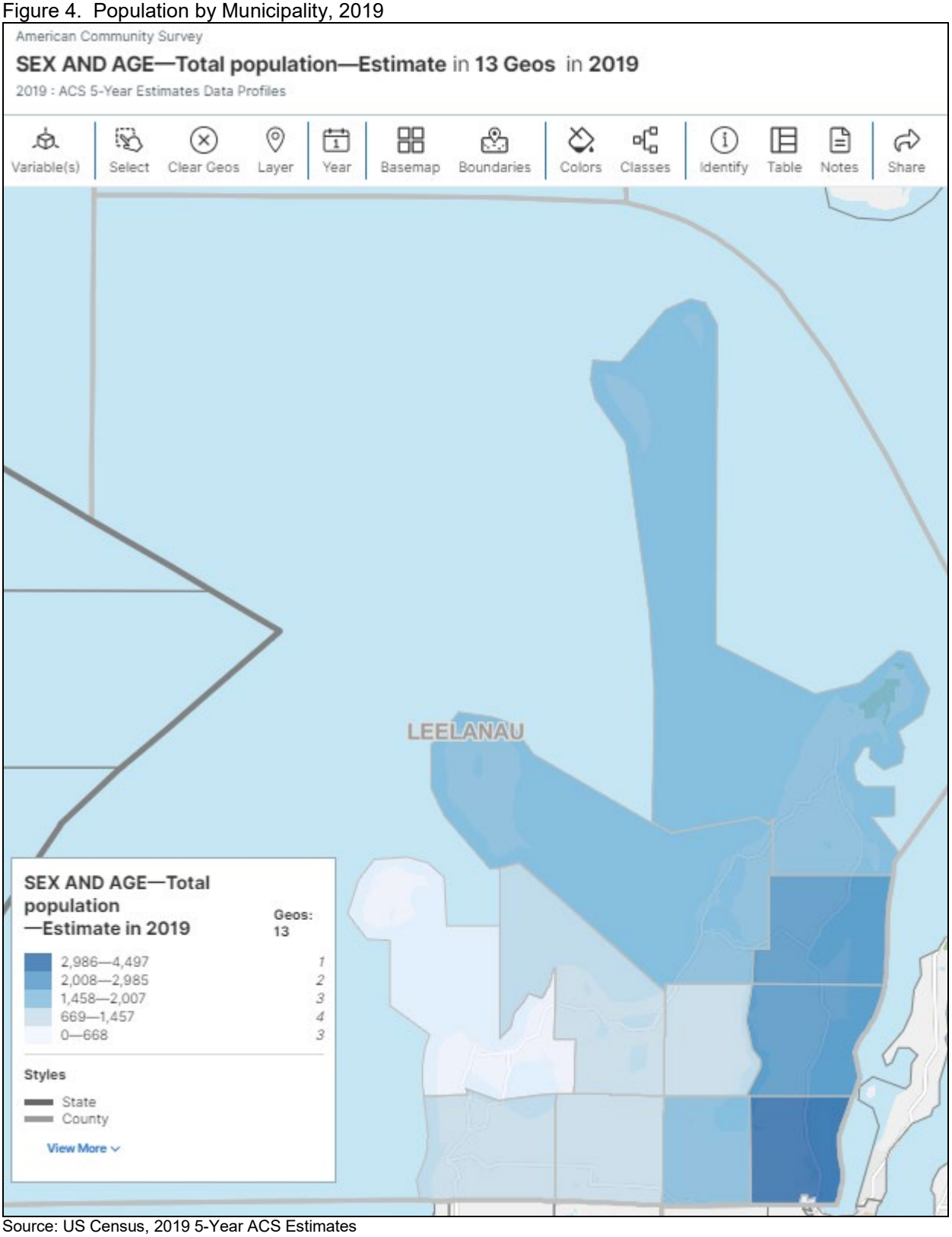
Table 3. Population by County, State, 2019

Jurisdiction	Population
Missaukee County	15,028
Kalkaska County	17,585
Benzie County	17,615
Leelanau County	**21,652**
Antrim County	23,206
Manistee County	24,457
Charlevoix County	26,188
Emmet County	33,104
Wexford County	33,256
Grand Traverse County	92,181
State of Michigan	9,965,265

Source: US Census, 2019 ACS 5-Year Estimates

[1] https://www.michigan-demographics.com/counties_by_population

Figure 4. Population by Municipality, 2019



Source: US Census, 2019 5-Year ACS Estimates

Table 4. Population Change by Municipality, 2010, 2019

Municipality	2010 Estimated Population	2019 Estimated Population	Numeric Change	Percent Change	Jurisdiction Status*
Village of Suttons Bay	607	544	-63	-63.0%	P
Village of Northport	411	457	46	46.0%	P
Village of Empire	260	263	3	3.0%	P
Leelanau County	**21,757**	**21,652**	**-105**	**-0.5%**	P
Elmwood Charter Township	4,493	4,497	4	0.1%	P
Suttons Bay Township	2,999	2,985	-14	-0.5%	P
Bingham Township	2,574	2,496	-78	-3.0%	P
Leelanau Township	1,843	2,007	164	8.9%	P
Leland Township	2,280	1,756	-524	-23.0%	P
Solon Township	1,490	1,747	257	17.2%	P
Kasson Township	1,639	1,457	-182	-11.1%	P
Centerville Township	1,289	1,449	160	12.4%	P
Cleveland Township	1,113	1,197	84	7.5%	P
Empire Township	1,101	1,161	60	5.4%	P
Glen Arbor Township	772	668	-104	-13.5%	P
City of Traverse City	164	232	68	41.5%	P

Source: US Census, 2010 and 2019 5-Year ACS Estimates
* 2023 Hazard Mitigation Plan Participation Status: P. A continuing participant or N. A non-participant

Like many northwest Michigan communities, Leelanau County experiences an influx of seasonal residents and tourists during the summer months. However, the decennial Census and the American Community Survey only consistently and comprehensively track the permanent population. The 2022 *Seasonal Population Study for Northwest Lower Michigan*, analyzed the 2020 seasonal population for ten counties in northwest Michigan. The study collected data for permanent and part-time residents and overnight visitors in accommodations and short-term rentals by County. Northwest Lower Michigan's permanent base population is 310,802 and expands to its largest seasonal population of 676,052 in July, 118% increase. Leelanau County increases by as much as 169% in July (22,301 to 60,094) (Table 5). On average, the population grows by 72% or 16,108 people throughout the year. All ten counties in the Networks Northwest service area were included in the study: Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford.

Table 5. Seasonal Population by Month

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Ave	Reg
Permanent Population	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	22,301	310,802
Combined Population	26,630	26,887	27,632	28,850	41,610	55,242	60,094	59,786	40,737	36,528	29,452	27,456	38,409	676,052
Difference	4,329	4,586	5,331	6,549	19,309	32,941	37,793	37,485	18,436	14,227	7,151	5,155	16,108	365,250
Percent Change	**19%**	**21%**	**24%**	**29%**	**87%**	**148%**	**169%**	**168%**	**83%**	**64%**	**32%**	**23%**	**72%**	**118%**

Source: Networks Northwest 2022 *Seasonal Population Study for Northwest Lower Michigan*

Age, Race & Disability

Understanding the age distribution and median age of Leelanau County can help identify social, economic, and public service needs in the community. The county's total estimated 2019 population is broken into age cohorts (analyzing which proportions of a municipality's population are in which stages of life). This gives a nuanced view of the makeup of a community. Figure 5 indicates the cohort group with the largest population is the 45 to 64 year old group, followed by those in 65-84 year old group. As shown in Figure 6, the median age (the midpoint where half the population is younger and half the population is older) of Leelanau County is older (54.1 years) than the State (39.7 years). The youngest community in the county is Traverse City with a median age of 44.7 years; the oldest community in the county is Glen Arbor Township with a median age of 65.5 years (Figure 7).

Figure 5. Leelanau County Population by Age Cohort, 2019

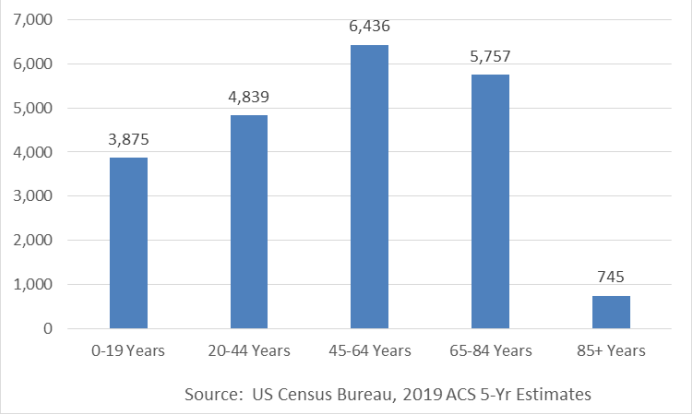
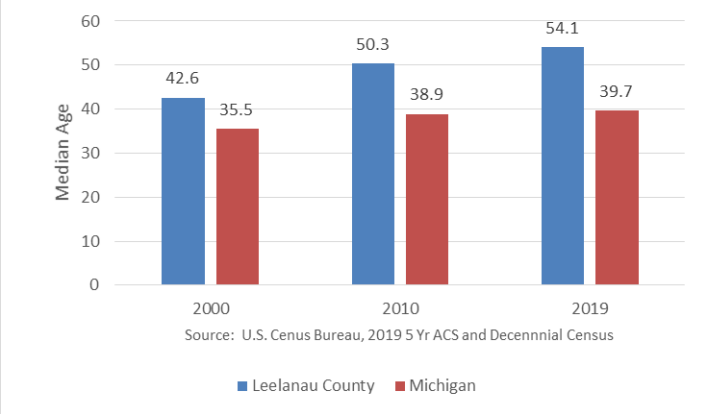
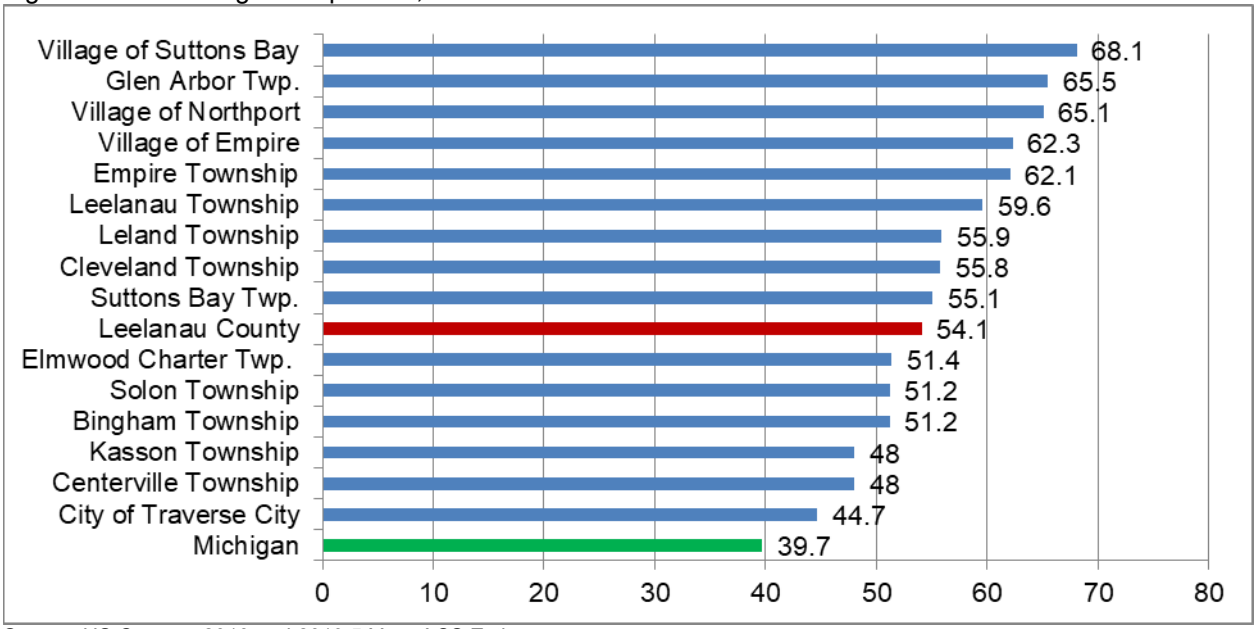


Figure 6. Median Age Trend, 2000, 2010, and 2019



Source: US Census, 2010 and 2019 5-Year ACS Estimates

Figure 7. Median Age Comparison, 2019

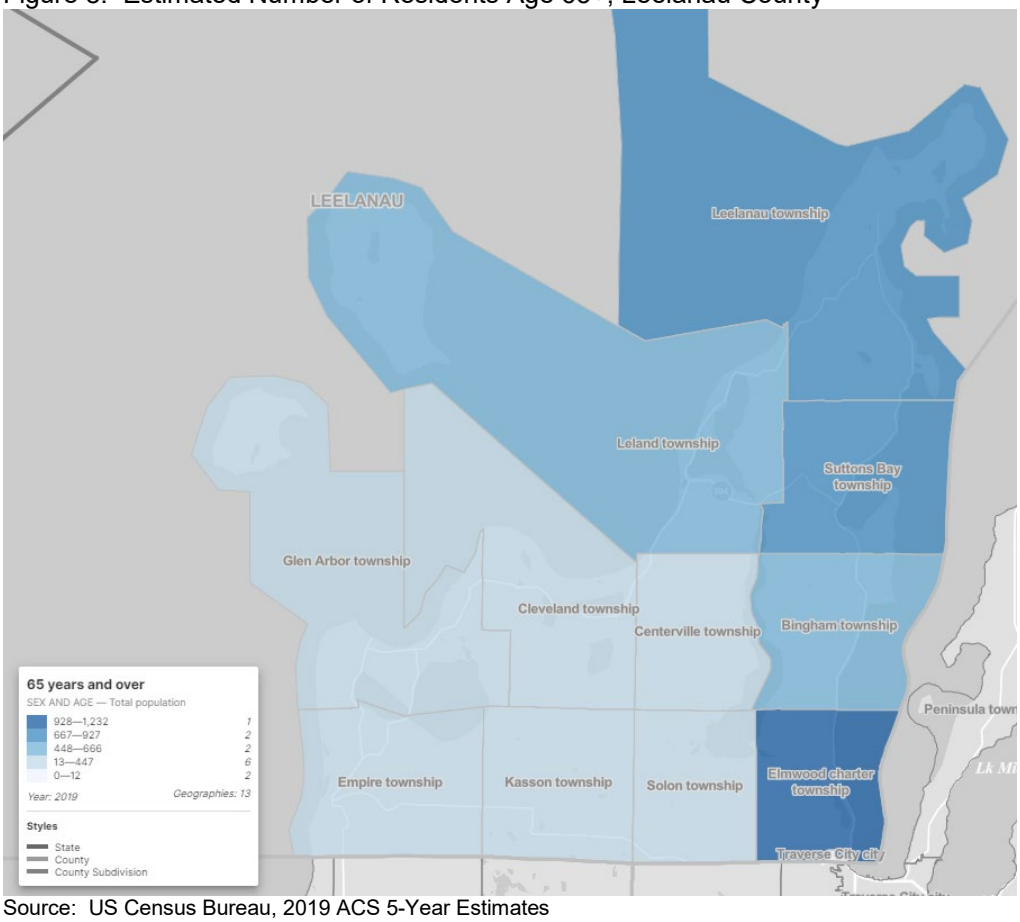


Source: US Census, 2010 and 2019 5-Year ACS Estimates

Persons over the age of 65 are considered a socially vulnerable population group. An estimated 53.8% of persons aged 65 years or older in Leelanau County has one or more type of disability (Table 9).

Figure 8 and Table 6 indicate that the greatest concentrations of this cohort are located in Elmwood Charter Township at 1,232 persons over age 65, followed by Suttons Bay, Leelanau, Bingham and Leland Townships. The data indicate where a greater focus on services may be needed for senior citizens to endure the impacts from hazard events such as extreme temperatures, severe winter weather, high winds, flooding, tornado, or a public health emergency.

Figure 8. Estimated Number of Residents Age 65+, Leelanau County



Source: US Census Bureau, 2019 ACS 5-Year Estimates

Table 6. Estimated Population Age 65+ by Jurisdiction

Leelanau County Jurisdiction	Est. Population Age 65+
Elmwood Charter Twp.	1,232
Suttons Bay Township	927
Leelanau Township	830
Bingham Township	666
Leland Township	565
Empire Township	447
Solon Township	402
Cleveland Township	385
Centerville Township	355
Glen Arbor Township	344
Kasson Township	337
City of Traverse City	12

Source: US Census Bureau, 2019 ACS 5-Year Estimates

The racial makeup of Leelanau County is predominantly white (94.7%) (Table 7). 4.3% of the population is American Indian or Alaskan Native; this is quite higher than representation in the State as a whole. 4.4% of the population is Hispanic or Latino (which may identify as any type of race); 1.2% is Black; 1.5% consists of two or more races; 0.9% is Asian; 0.9% is of some other race; and 0.1% is Native Hawaiian or Other Pacific Islander.

Table 7. Racial Composition in the State of Michigan and Leelanau County, 2019

	White	Black	American Indian or Alaskan Native	Asian	Hispanic or Latino	Native Hawaiian or Other Pacific Islander	Some Other Race	Two or More Races
Leelanau County	94.7%	1.2%	4.3%	0.9%	4.4%	0.1%	0.9%	1.5%
Michigan	75.0%	13.6%	0.5%	3.1%	5.1%	0.1%	0.1%	2.5%

Source: US Census 2019 5-Year ACS Estimates

Looking more closely at the communities within Leelanau County, yellow highlighted entries in Table 8 indicate concentrations of minority populations, greater than 20 persons, by geography. Most notably, Suttons Bay Township has 423 persons (16.4% of the township population) that identify as American Indian and Alaska Native alone (and not of Hispanic or Latino origin). The Grand Traverse Band Tribe of Ottawa and Chippewa Indians has reservation land in this township. Suttons Bay Township also has an estimated 404 persons identifying as of Hispanic or Latino origin, with 88 of those as being of "some other race alone" and 71 of those as being of "two or more races".

All Leelanau County communities (excluding the City of Traverse City) contain estimates of non-white residents, which are considered socially vulnerable populations in a natural hazard event scenario. There may be an increased need for public assistance in these communities as these population groups may have limited social and financial resources to withstand or recover from a hazard event. Those identifying as being of Hispanic or Latino Origin may also not be fluent in the English language, which could be a communication challenge for receiving public notices/warnings prior to or during a hazard event, or during rescue and recovery efforts after a disaster.

Table 8. Racial Composition Estimates for Leelanau County Communities

	Bingham Township	Centerville Township	Cleveland Township	Elmwood Township	Empire Township	Glen Arbor Township	Kasson Township	Leelanau Township	Leland Township	Solon Township	Suttons Bay Township	City of Traverse City
Not Hispanic or Latino:	2,351	1,375	1,180	4,479	1,161	644	1,412	1,923	1,655	1,714	2,581	232
White alone	2,223	1,356	1,159	4,275	1,126	617	1,364	1,793	1,604	1,680	2,059	232
Black or African American alone	0	6	7	0	5	**23**	0	23	11	0	19	0
American Indian and Alaska Native alone	**81**	9	13	**87**	3	0	12	13	0	4	**423**	0
Asian alone	4	0	0	**78**	15	4	6	0	4	7	16	0
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	17	0	0	0	0
Some other race alone	0	0	0	0	0	0	0	0	0	12	0	0
Two or more races	**43**	4	1	**39**	12	0	**30**	**77**	**36**	11	**64**	0
Hispanic or Latino:	**145**	**74**	17	18	0	**24**	**45**	**84**	**101**	33	**404**	0
White alone	67	0	17	3	0	24	42	66	95	26	221	0
Black or African American alone	0	0	0	0	0	0	0	0	6	0	5	0
American Indian and Alaska Native alone	14	0	0	0	0	0	0	0	0	0	19	0
Asian alone	0	0	0	0	0	0	3	0	0	0	0	0
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	0	0	0	0	0
Some other race alone	**64**	0	0	0	0	0	0	18	0	7	**88**	0
Two or more races	0	0	0	15	0	0	0	0	0	0	**71**	0

Table 9 represents the number of persons with a disability by age group. An estimated 2,806 (13.1%) of Leelanau County residents have one or more type of disability. An estimated 53.8% of those with one or more disabilities are aged 65 years or older.

Table 9. Persons with a Disability, 2019

Total Civilian Noninstitutionalized Population	21,495 persons
With one or more disability	2,806 (13.10%)
Age 0-17 with a disability	95 (4.3% of that age group)
18 to 64 years with a disability	1,081 (17.4% of that age group)
65 years and over with a disability	1,630 (53.8% of that age group)

Source: US Census 2019 5-Year ACS Estimates

Housing Characteristics and Development Trends

The average household size for Leelanau County residents is 2.32 persons, which is slightly lower than the State's average of 2.46. Leelanau County has an estimated 15,638 total households as reported in the 2019 ACS 5-Year Estimates. The Census defines a household as all the people who occupy a single housing unit, regardless of their relationship to one another.

Leelanau County has an estimated 15,638 housing units (Table 10). Leelanau Township has the largest percentage of housing units of all municipalities in the county, 2,113 or 13.5%, followed by Elmwood Charter Township, 2,084 or 13.3%. Over 43% of residential units were built before 1980 (Table 11). The 2019 ACS also estimates that 86% (13,445) of the county's household units are 1-unit, detached structures, which are commonly referred to as single-family homes. The number of housing units for each village is incorporated into the totals for the respective township in which each village is located.

Table 10. Housing Units by Municipality, 2019

	Total Housing Units	% of Total
Leelanau County	**15,638**	
Village of Northport	247	1.6%
Village of Suttons Bay	239	1.5%
Village of Empire	141	0.9%
Leelanau Township	2,113	13.5%
Elmwood Charter Township	2,084	13.3%
Leland Township	1,776	11.4%
Glen Arbor Township	1,766	11.3%
Suttons Bay Township	1,711	10.9%
Bingham Township	1,427	9.1%
Empire Township	1,191	7.6%
Cleveland Township	926	5.9%
Centerville Township	925	5.9%
Solon Township	849	5.4%
Kasson Township	772	4.9%
City of Traverse City	98	0.6%

Source: US Census, 2019 ACS 5-Year Estimates

Table 11. Year Structure Built, 2019

Housing Units	Number	% of Total
Built 2010 or later	632	4.0%
Built 2000-2009	2,408	15.4%
Built 1980-1999	5,837	37.3%
Built 1960-1979	3,470	22.2%
Built 1940-1959	1,398	8.9%
Built 1939 or earlier	1,893	12.1%
Total Housing Units	**15,638**	

Source: US Census, 2019 ACS 5-Year Estimates

Housing Tenure, Table 12, summarizes the status of housing units, whether occupied or vacant, as well as the median housing value of owner-occupied units ($268,400) and the median gross rent ($959). Of the 15,638 total housing units, 9,139 (58.4%) are occupied (indicating physically occupied, principal residence housing units).

Table 12: Housing Tenure, 2019

Total housing units	15,638	%
Occupied housing units	9,139	58.4%
Owner-occupied units	8,071	88.3%
Median Housing Value	$268,400	
Renter-occupied units	1,068	11.7%
Median Gross Monthly Rent	$959	
Vacant housing units	6,499	41.6%

Source: US Census, 2019 ACS Estimate

Economic Profile

The *2021 Comprehensive Economic Development Strategy (CEDS)* prepared by Networks Northwest is the product of a locally-based, regionally-driven economic development planning process to identify strategies for economic prosperity. The plan was prepared for the ten county region of northwest Lower Michigan. Table 13 provides a comparison of annual average wage for each county in the CEDS planning area for 2018. Kalkaska County has the highest average annual wage with $ 50,971, followed by Grand Traverse County at $44,562. Leelanau County has the 6th highest average annual wage at $36,833. As their northern/northwestern neighbor, it is not unexpected to have residents of Leelanau County travel to Grand Traverse County for work.

Table 13. Average Annual Wage by County, 2018

County	Average Annual Wage
Antrim	$33,081
Manistee	$33,821
Benzie	$33,908
Missaukee	$35,917
Leelanau	**$36,833**
Emmet	$40,258
Wexford	$40,586
Charlevoix	$44,558
Grand Traverse	$44,562
Kalkaska	$50,971

Source: 2021 Comprehensive Economic Development Strategy (CEDS) prepared by Networks Northwest

The Economic Profile of Leelanau County is further described in Table 14. The table provides the county's industry makeup divided into 20 different North American Industry Classification Sectors (NAICS) as well as industry's establishments, jobs, percent distribution, and annual average wage. The industry with the largest percent distribution is "**Other (includes private, management of business, and unallocated)**" at 19.6% of jobs, followed by "**Accommodation and Food Service**" at 13.7%, and "**Construction**" at 9.1%. The annual average wage for "Other" is not available; for "Accommodation and Food Services" is $24,207; and for "Construction" is $43,924. "**Retail Trade"** is the fourth largest industry with 8.9% of jobs in the county, at an annual average wage of $22,325. The industry with the highest annual average wage is "**Finance and Insurance**" at $77,656, followed by "**Health care, social assistance**" at $55,148.

Table 14: Leelanau County Economic Distribution by Industry, 2018

Industry	Establishments	Jobs	% Distribution of Jobs	Annual Average Wage
Total Covered Employment	682	6,454	100.00%	$36,833
Agri., forestry, hunting	41	D	D	D
Mining	4	D	D	D
Construction	109	586	9.10%	$43,924
Manufacturing	39	495	7.70%	$30,100
Wholesale trade	13	265	4.10%	$27,582
Retail trade	97	574	8.90%	$22,325
Transportation, warehousing	17	84	1.30%	$41,934
Information	13	54	0.80%	$31,478
Finance and Insurance	19	137	2.10%	$77,656
Real Estate, rental, leasing	25	90	1.40%	$35,371
Professional, technical services	48	D	D	D
Administrative, waste services	38	197	3.10%	$39,317
Educational services	10	427	6.60%	$42,386
Health care, social assistance	35	477	7.40%	$55,148
Arts, entertainment, recreation	24	244	3.80%	$34,571
Accommodation and food services	75	886	13.70%	$24,207
Other services (except for Public admin.)	52	158	2.40%	$32,748
Public administration	18	517	8.00%	$44,445
Other Includes (private, utilities, management of business, and unallocated)	5	1,263	19.60%	N/A

Source: 2021 Comprehensive Economic Development Strategy, Networks Northwest
**D means limited industries of a sector that would disclose confidential information*

Additionally, OnTheMap, an online interactive tool available from the US Census Bureau, allows for viewing of estimated job density within the county. This website is useful for emergency preparedness planning as related to response and potential impact to local economic activity areas. It appears the greatest density of jobs are located within the Traverse City/Greilickville and Peshawbestown areas (Figure 9). Other key areas of employment are in the Villages of Northport, Empire, and Suttons Bay, as well as Lake Leelanau, Leland, the Leelanau County Campus, Glen Arbor, Cedar, and Maple City (Figure 10). Below are screenshots of the interactive map when completing an area profile analysis for all workers in all jobs in the county in 2019.

Figure 9. OnTheMap Web Image, Leelanau County South

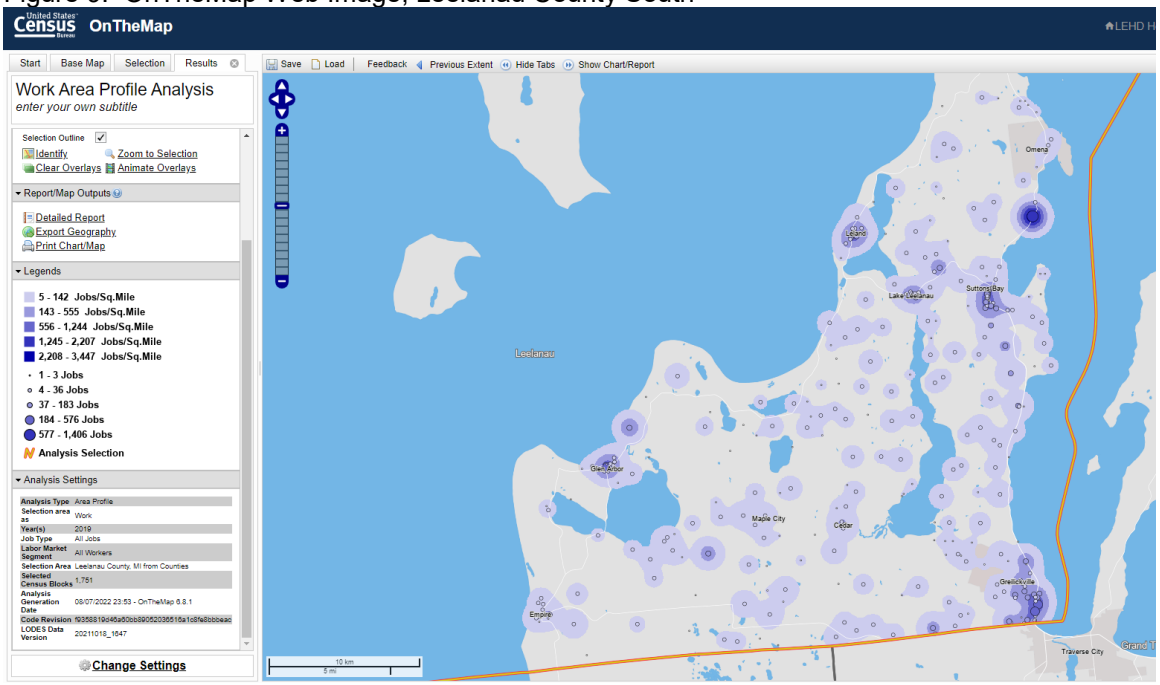
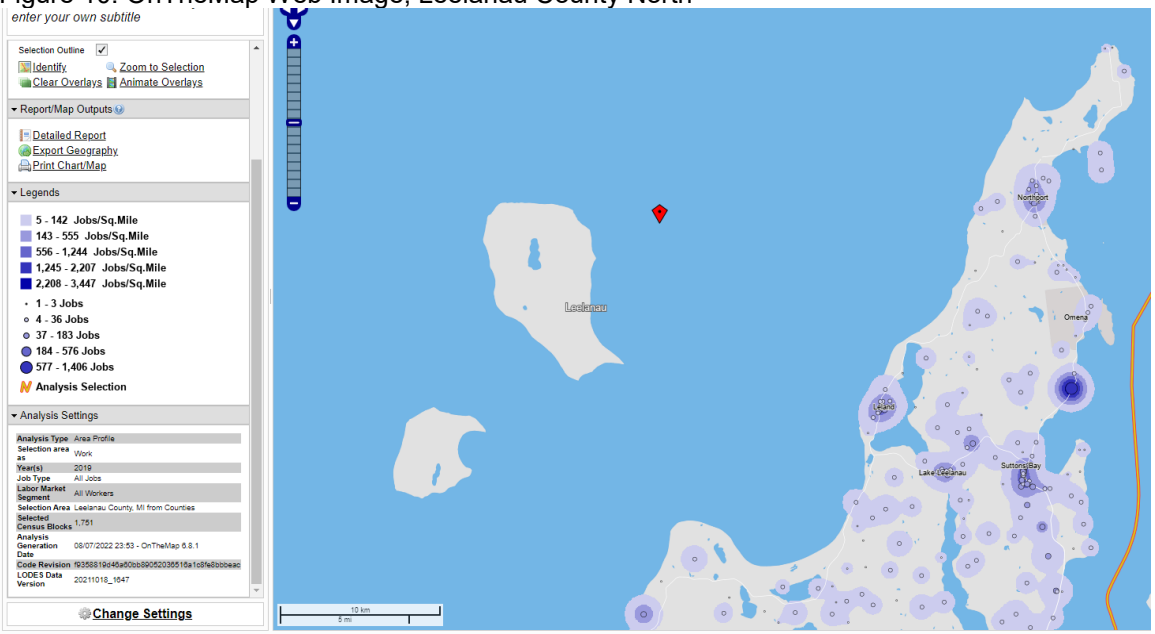


Figure 10. OnTheMap Web Image, Leelanau County North

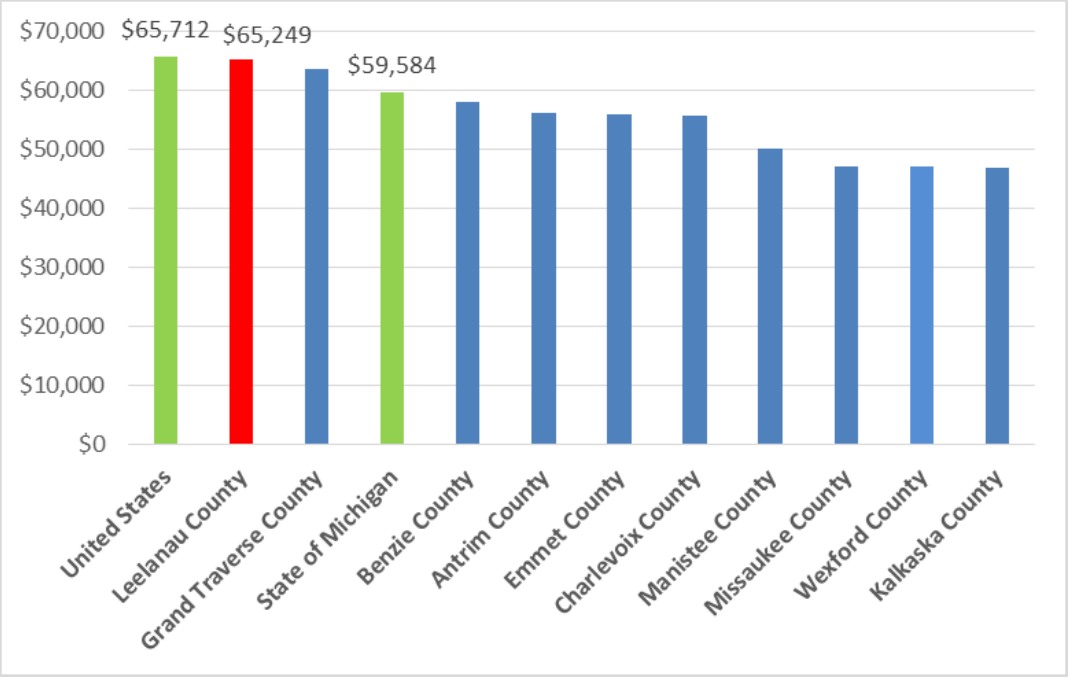


Source: US Census, OnTheMap

Figures 11 and 12 present a comparison of the median household income (MHI) across the ten county region, the State of Michigan, and local jurisdictions. Leelanau County has the highest median household income ($65,249) in the region, which is also above that of the State. The county's economic profile can be further described by considering the cost of housing, transportation, and other goods and services. The budgeting rule of thumb has been that a household should spend no more than 30 percent of its income on housing costs. Considering the MHI of Leelanau County over twelve months, a household is earning $5,437 per month. Leelanau County households should spend no more than $1,631 on housing costs. The US Census 2019 5-year ACS estimates that the median gross monthly rent is $959 in Leelanau County.

However, according to the 2019 Northwest Michigan Target Market Analysis[2] (conducted by LandUseUSA on behalf of Housing North and Networks Northwest), rents are far higher in Leelanau County than what many renters can afford. While the affordable rent for a renter earning the mean wage in the county is $796, the affordable rent for a full-time minimum wage worker is $491. And anecdotally, the demand for housing is driving prices higher still. Home prices are also increasing where the cost to purchase a home is often as much as $200/square foot or more.

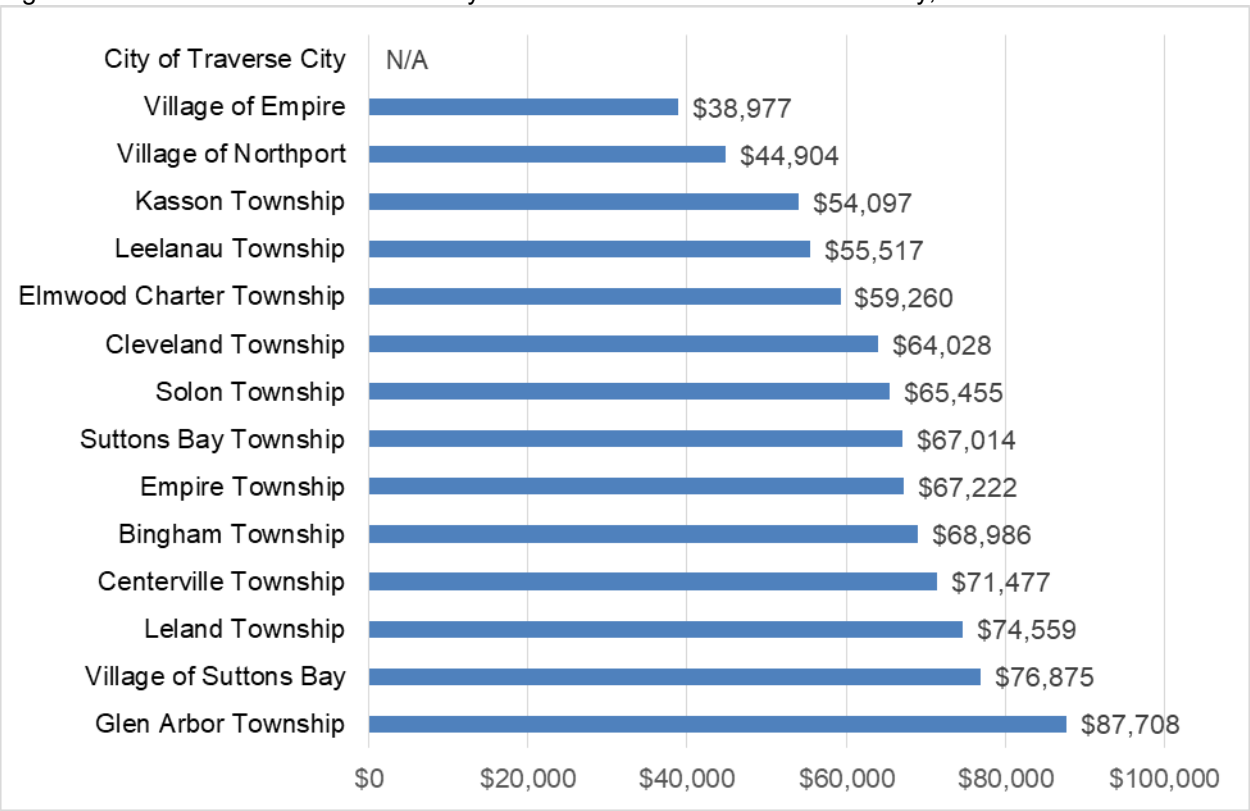
Figure 11. Northwest Michigan Median Household Income by County, 2019



Source: US Census, 2019 ACS Estimate

[2] https://www.housingnorth.org/target-market-analysis

Figure 12. Median Household Income by Local Jurisdiction in Leelanau County, 2019



Source: US Census, 2019 ACS Estimates
Note: no data available for the City of Traverse City within Leelanau County

The following tables describe the population with the lowest incomes. It is estimated, in 2019, that 2.6% of all people in the county lived at or below the poverty level (Table 16). The Census describes poverty thresholds differently based on the size of the family and the number of related children living together, as illustrated in Table 15 below.

Table 15. 2019 Federal Poverty Level Guidelines

Persons in family/household	Poverty guideline
1	$12,490
2	$16,910
3	$21,330
4	$25,750
5	$30,170
6	$34,590
7	$39,010
8*	$43,430

**For families/households with more than 8 persons, add $4,420 for each additional person.*

Table 16. Poverty Estimates, 2019

Poverty	Statistics
All families living below the poverty level	2.6% (163)
Families with related children under age 18, in poverty	3.9% (72)
All persons living below the poverty level	6.1% (1,310)

Source: US Census, 2019 ACS Estimates

Financial hardship is further described in the United Ways of Michigan report entitled *ALICE in Michigan: A Financial Hardship Study*. ALICE, which is an acronym for Asset Limited, Income Constrained, Employed, are those households with income above the Federal Poverty Level, but below the basic cost of modern living, such as housing, child care, food, health care, technology and transportation. The ALICE threshold is described as, "*the average income that a household needs to afford the basic necessities… for each county in Michigan. Households earning below the ALICE Threshold include both ALICE and poverty-level households*" (ALICE, 2019). Table 17 identifies the number of ALICE and poverty households for the county and each municipality. These households likely would not have reserve savings to cover an emergency, such as impacts to their personal property from a natural hazard event.

Every community in Leelanau County contains low-income households, which are considered to be socially vulnerable populations. These households may have more of a need for social/public services, such as assistance with transportation, food, water or shelter, during or after a hazard event. The estimated numbers of these households are shown in Table 17, with Elmwood Charter Township containing the most, followed by Suttons Bay Township and Leelanau Township. Additionally, 52% of the households in Kasson Township and 50% of the households in Leelanau Township are estimated to be living in poverty or are ALICE.

Table 17. ALICE Report Findings, 2019[3]

Leelanau County Jurisdiction	Total Households	% of all HH that are in Poverty and ALICE	# of all HH that are in Poverty and ALICE
Leelanau County	9,179	37% (State Avg. is 25%)	3,396
Bingham Township	1,078	38%	410
Centerville Township	587	40%	235
Cleveland Township	513	45%	231
Elmwood Charter Township	1,839	46%	846
Empire Township	572	43%	246
Glen Arbor Township	323	23%	74
Kasson Township	593	52%	308
Leelanau Township	938	50%	469
Leland Township	756	34%	257
Solon Township	676	43%	291
Suttons Bay Township	1,180	43%	507

Source: United Ways of Michigan; based on US Census Bureau 2019 ACS 5-yr Estimates Data

[3] Michigan Association of United Ways. *ALICE in Michigan: A Financial Hardship Study*. 2021. https://www.uwmich.org/alice-report

IV. Hazard Identification and Assessments

Vulnerability Assessment

Natural hazard impact on the community can be understood by evaluating vulnerabilities for commonly agreed upon assets. A community's assets are defined broadly to include anything that is important to the character and function of a community and can be described very generally in the following categories:

- People
- Economy
- Built environment
- Natural environment

Vulnerable populations include the economically disadvantaged, elderly, homeless, and persons with a disability. Those that live unsheltered or in homeless encampments, assisted living facilities, mobile home parks, or isolated subdivisions are more susceptible to hazardous events. Vulnerable populations are represented on the *Vulnerable Populations and Hazard Areas Map* in Appendix A. Those locations included on the map were specifically discussed during public input sessions. There may be additional locations of vulnerable populations that are not listed.

The natural environment is the primary feature residents choose to live in northwest Michigan and the primary feature visitors choose to vacation in northwest Michigan. Leelanau County is home to forest lands, inland lakes and streams, unique sand dune areas, Lake Michigan shoreline and all of the wildlife within that are integral to the identity of the community. While natural resources are abundant they are vulnerable to all types of hazards. Northwest Lower Michigan is also home to many sensitive wildlife populations that require specific climates and habitats to survive. Damaged, destroyed, or changing natural environments may decrease the chances for certain species' survival.

Additionally, countywide critical infrastructure is represented on the Critical Infrastructure Map in Appendix A. Leelanau County Office of Emergency Management and community stakeholders identified the critical facilities and infrastructure on the base map. Table 18 is a summary of critical infrastructure points in Leelanau County.

Table 18. Critical Facilities and Infrastructure

No. of Facilities	Facility Type
23	**Communications** • Wireless Communications Facilities (22) • Satellite Communications Facility (1)
14	**Emergency Services** • Law enforcement (3) – (County Jail, Sheriff's Office, GTB Police) • Fire and emergency medical services (10) • Emergency Management (1) – Leelanau County EM/911
18	**Energy** • Electricity
14	**Government Facilities** • Municipal raw water supply (5) • Municipal waste water treatment facilities (4) • Dams (5)
15	**Healthcare** • Extended care facilities (9) • Ambulatory, public health or health supporting facilities (6)
15	**Industry** • Hazardous Chemical Storage/Stockpile/Utilization/Distribution (1) • Manufacturing (food, beverage, furniture, fabricated metal products, computer & electronic products - 14)
24	**Transportation** • Airport (1) • Airfields/Airstrips (5) • Bays (8) • Marinas (10)

Source: Leelanau County Emergency Services

Historical Analysis

The Historical Analysis of Leelanau County weather-related hazards uses information on impacts and losses from previous hazard events to predict potential impacts and losses during a similar event. Because of the frequency of these events, communities are more likely to have experience with and data on impacts and losses. Additionally, there have been seven (7) federal-or state-declared disaster incidents that have involved Leelanau County (Table 19). These are included in the hazard analysis for individual event types.

Table 19: Presidential and Governor Declared Disasters or Emergencies for Leelanau County

Date of Declaration	Type of Incident	Affected Area	Type of Declaration/ Fed ID#
March 2020	COVID-19; Pandemic	Statewide & National	State of Emergency, National Emergency (3455), and Governor and Presidential Declared Major Disaster (4494)
1/29/2019	Extreme Cold	Statewide	Governor Declared Emergency
8/2/2015	Thunderstorms	Grand Traverse County and Leelanau County	Governor Declared Disaster
9/4/2005 and 9/7/2005	Hurricane (Katrina) Evacuation	Statewide (Declared due to the emergency conditions in the State of Michigan, resulting from the influx of evacuees from states impacted by Hurricane Katrina beginning on August 29, 2005.)	Governor Declared Disaster and Presidential Declared Emergency (3225)
1/26-27/1978	Blizzard, Snowstorm	Statewide	Presidential Declared Emergency (3057); Governor Declared Disaster
3/2/1977	Drought	Leelanau and 43 other counties	Presidential Declared Emergency (3035)
4/5/1956	Tornado	4 Counties: Benzie, Leelanau, Manistee and Ottawa	Presidential Declared Major Disaster (53)

Sources: FEMA https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties and Michigan State Police 2019 Michigan Hazard Analysis (MHA) pub. 103

Hazard Descriptions

Leelanau County is vulnerable to a wide range of natural hazards. Hazard events have the potential to impact local residents, economic drivers in the community, critical infrastructure and the built environment, and the natural environment. The Leelanau County Emergency Services Department is challenged with managing these threats to protect life and property. This plan includes a profile for each hazard event the county is likely to face. Each profile includes the location, extent, previous occurrences, probability of future events, and vulnerability assessment.

- Location is the geographic areas within the planning area that are affected by the hazard, such as a floodplain. The entire planning area may be uniformly affected by some hazards, such as drought or a winter storm. Location may be described in narrative and/or through map illustrations.
- Extent is the strength or magnitude of the hazard. Extent can be described in a combination of ways depending on the hazard.
- Previous occurrences describe the history of previous hazard events within the county. This information helps estimate the likelihood of future events and predict potential impacts. The extent of historic events may be included when the data is available. Severe weather event data is primarily collected from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database.
- Probability of future events is the likelihood of the hazard occurring in the future and any trends that may appear. Probability may be defined using historical frequencies or statistical probabilities.
- Vulnerability assessment accounts for the type, amount, and value of assets such as: existing and future buildings, infrastructure, critical facilities, populations, recreation areas and environmental features that may be impacted by a hazard, along with existing community assets to mitigate or respond to the hazard.

Data for natural hazard events in Leelanau County was compiled from several different sources. Weather event data was collected primarily from the National Centers for Environmental Information through the National Oceanic and Atmospheric Administration's (NOAA) website. All data sources include:

- FEMA's webpage on Disaster Declarations for States and Counties was referenced for the most up-to-date data on Presidential- and Governor-Declared emergencies and disasters pertaining to Leelanau County (Table 19).

- Climate https://www.weather.gov/wrh/Climate?wfo=apx – Historical local observed weather data; Climate prediction and variability; local high impact event summaries

  NOAA Storm Events Database https://www.ncdc.noaa.gov/stormevents/ - Data available to search beginning in 1950 to within approximately 3 months prior to present day; however, information on record for various types of events is limited and non-contiguous. The database provides local storm reports, damage reports, and recorded event descriptions. The event types researched for Leelanau County include the following (the event types in italics are as these types of events are listed in the Storm Events Database):
  - Dangerous Currents (i.e., *Rip Current*)
  - Dense Fog (*Dense Fog*)
  - Drought (*Drought*)
  - Extreme Temperatures (*Cold/Wind Chill, Extreme Cold/Wind Chill, Heat, Excessive Heat)*
  - Extreme Winter Weather (*Blizzard, Freezing Fog, Frost/Freeze, Heavy Snow, Ice Storm, Lake-Effect Snow, Sleet, Winter Storm, Winter Weather*)
  - Flooding *(Flash Flood, Flood*)
  - Hail (*Hail*)
  - Seiche (Seiche)
  - Shoreline Flood (*Lakeshore Flood*)
  - Thunderstorm and High Wind (*Heavy Rain, Lightning, High Wind, Strong Wind, Thunderstorm Wind*)
  - Tornado (*Tornado, Funnel Cloud, Waterspout*)
  - Wildfire (*Wildfire*)

- The *Michigan Hazard Analysis*, completed by the Michigan Department of State Police in 2019, was referenced to collect data on wildfires that occurred on State of Michigan owned land between 1981 and 2018 (as reported by the MDNR).

- The websites for the National Inventory of Dams and MI-EGLE's Michigan Dam Inventory were used to collect information on dams in the county.

- The Great Lakes Current Incident Database https://www.michiganseagrant.org/dcd/dcdsearch.php provided by the National Weather Service and Michigan Sea Grant provides a list of all types of dangerous current-related fatalities and rescues on the Great Lakes from 2002 to 2020.

The NOAA – NCEI Storm Events Database is updated on a rolling basis, and thus the database is always being added to. The most up to date information was added to Table 20, but as events occur the database will change. There were 257 events were reported between 01/01/1950 and 12/31/2022 (26,663 days). However, it is important to note that the earliest date of an event recorded in the database for Leelanau County is 1996. There were a total of 214 days with an event, 2 days with an event and death, 2 days with an event and death or injury, 35 days with an event and property damage, and 6 days with an event and crop damage. Those events, as well as any wildfires on MDNR land, and State and Federal emergency or disaster declarations, are included in the hazard analysis. The hazard analysis groups the events into the following categories:

Table 20. Number of Events by Type

Type of Event	# of Events	Event Location	Time Interval/ Year Event Recorded
Extreme Winter Weather	139	Countywide	1978*, 1996-2016, 2018-2022
Thunderstorm/Wind; High/Strong Winds	65	Countywide	1975, 1982, 1987, 1995, 1999-2003, 2005, 2007-2011, 2013, 2015, 2017-2022
Hail	35	Countywide	1998, 2000-2009, 2011, 2013, 2015-2017, 2021
Shoreline Hazards (Lakeshore Flooding, Seiche, Rip Current)	5	Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Leland Township, Leelanau Township, Suttons Bay Township, Bingham Township, Elmwood Township, Village of Northport, Village of Suttons Bay, Village of Empire	2012, 2019 (3), 2020
Flash Flood	4	Countywide; Empire & Solon Townships	1999, 2000, 2021 (2)
Tornado	3	Glen Arbor Township, Cleveland Township, Leland Township, Suttons Bay Township	1977, 1978, 2011
Extreme Temperatures (Cold / Heat)	3 / 2	Countywide	2007, 2008; 2019* / 2001, 2018
Drought	2	Countywide	1977*, 2001
Lightning	2	Countywide; Solon Township	2000, 2007
Wildfire	60	MDNR Lands	1981-2018
Public Health Emergency (COVID-19 Pandemic)	1	Countywide	2020 - 2023
Invasive Species	Ongoing	Countywide	Ongoing

Sources: NOAA National Centers for Environmental Information Storm Events Database; MDNR; Michigan State Police-Dept. of Homeland Security; FEMA; Great Lakes Current Incident Database.
Note: * indicates a state or federal emergency or disaster event designation

Economic Impact Analysis

Table 21 presents the *reported* deaths, injuries, property damages, and crop damages of storm events in Leelanau County from 1950-2021. There were two deaths and zero injuries. One death occurred from an extreme cold event on February 10, 2008, and the other death occurred from a rip current on August 30, 2012. The estimated economic impact of the previously described Leelanau County natural hazard events that were *reported* to NOAA is $25,576,000 in property damages and $53,563,000 in crop damages. It should be noted that many events likely cause numerous small amounts in property damage, but this often goes unreported. The total reported Damaging Events' Costs recorded with NOAA for Leelanau County are as follows:

Table 21. Extent of Damage by Event Type

Leelanau County	Deaths	Injuries / Illness	Property Damage Estimate	Crop Damage Estimate
Thunderstorm/Wind; High Winds	0	0	$24,269,000	$8,000
Extreme Winter Weather	0	0	$832,000	$50,500,000
Hail	0	0	$85,000	$3,055,000
Shoreline Hazards (Lakeshore Flooding, Seiche, Rip Current)	1	0	$184,000	$0
Flash Flood	0	0	$50,000	$0
Tornadoes	0	0	$295,000	$0
Extreme Temperatures (Cold / Heat)	1	0	$0	$0
Drought	0	0	$0	$0
Lightning	0	0	$40,000	$0
Wildfire	0	0	$0	$0
Public Health Emergency (COVID-19 Pandemic)	63	4,173	n/a	n/a
TOTALS	**65**	**4,173**	**$25,576,000**	**$53,563,000**

Sources: NOAA's National Centers for Environmental Information; https://www.michigan.gov/coronavirus/stats
* According to the State of Michigan, this is the total of confirmed and probable deaths and illnesses for COVID-19 in Leelanau County as of as of October 4, 2022.

Table 22 provides an overview of each potential hazard's impact on the permanent population and the estimated impact on the State Equalized Values (SEV) for real and personal property (residential and commercial). The SEV is equal to half of the True Value of the property. Population data is collected from the US Census, 2019 ACS data. According to the 2022 *Seasonal Population Study for Northwest Lower Michigan*, assume a 169% increase from the base population of permanent residents to account for the highest estimated annual average seasonal population within the county (which occurs in July).

Table 22. Geographic Economic Impact by Event

Hazard Event	Geography	Population Estimates	State Equalized Value
Extreme Winter Weather, Thunderstorm, Wind, Hail, Lightning, Tornado, Extreme Temperatures, Drought, Public Health Emergency	These hazards have the potential to impact all communities in Leelanau County	21,652	$4,219,402,702.00
Flooding	Bingham Township, Centerville Township, Cleveland Township, Glen Arbor Township, Kasson Township, Leelanau Township, Solon Township, Leland Township, Suttons Bay Township, Elmwood Township, City of Traverse City, Village of Suttons Bay, Village of Northport	20,491	$514,117,893.58
Shoreline Erosion/Flooding & other Shoreline Hazards	Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Leland Township, Leelanau Township, Suttons Bay Township, Bingham Township, Elmwood Township, Village of Northport, Village of Suttons Bay, Village of Empire, and City of Traverse City	18,448	$687,023,270.39
Wildfire	Pine Forest Areas Countywide (White, Red, and Jack Pine)	21,652	$271,192,557.90
Wildfire	Fire Prone Areas: Leland Township, Leelanau Township, Centerville Township, Cleveland Township, Glen Arbor Township, Elmwood Township, Solon Township, Kasson Township, Empire Township, Village of Empire	15,939	$140,911,313.88

Sources: 2019 ACS Estimates from the U.S. Census Bureau; Leelanau County Equalization

Extreme Winter Weather

The National Weather Service defines a winter weather event as: *a winter weather phenomenon (such as snow, sleet, ice, wind chill) that impacts public safety, transportation, and/or commerce. It typically occurs during the climatological winter season between October 15 and April 15.* The Extreme Winter Weather category in this Plan's hazard analysis includes the following subcategories: winter weather, winter storm, ice storm, heavy snow, blizzard, frost/freeze, and lake effect snow. Blizzards are the most perilous snowstorms and are characterized by low temperatures, strong winds, and enormous amounts of fine, powdery snow. Snowstorms have the potential to reduce visibility, cause property damage, and loss of life.

According to the 2019 Michigan Hazard Analysis, the 29 counties of the Northern Lower Peninsula of Michigan have an annual average of 79 snowstorm events, with 0 average annual deaths or injuries, $6.53 million in average annual property damage and $20 million in crop damage. Michigan experiences large differences in snowfall over short distances due to the Great Lakes. The average annual snowfall accumulation ranges from 30 to 200 inches with the highest accumulations in the northern and western parts of the Upper Peninsula. In Lower Michigan, the highest snowfall accumulations occur near Lake Michigan and in the higher elevations of northern Lower Michigan. For example, the average snowfall ranges from 141 inches in the Gaylord area to 101 inches in Traverse City.

Ice and sleet storms generate sufficient quantities of ice or sleet that result in hazardous conditions and/or property damage. Ice storms occur when cold rain freezes on contact with the surface and coats the ground, trees, buildings, and overhead wires with ice. Ice storms are often accompanied by snowfall, which can cause property damage, treacherous conditions, and power loss. When electric lines are down, households are inconvenienced, and communities experience economic loss and the disruption of essential services. Conversely, sleet storms are small ice pellets that bounce when hitting the ground or other objects. The ice pellets do not stick to objects, but can cause hazardous driving conditions.

According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 16 average annual ice and sleet storm events with 0.2 average annual deaths, 0.5 average annual injuries, and $11.4 million in average annual property and crop damage.

Location
Extreme winter weather events are regional events that are not confined to geographic boundaries and can affect several areas at one time with varying severity depending on factors such as elevation and wind patterns. All of Leelanau County is at risk to the occurrence and impacts from extreme winter weather; the county is more susceptible to lake-effect snow due to proximity to Lake Michigan.

Extent
Snowstorms can be measured based on snowfall accumulations or damages. Leelanau County receives the most snowfall in January with a normal amount of 26.3 inches followed by December with 21.2 inches, and February with 19 inches. Snowfall in March, April, and November are each 12.6 inches or less.

Table 23 is a summary of winter weather events. Extreme winter weather events in total caused $653,000 in property damages and $50,500,000 in crop damages on record with NOAA.

Table 23: Extreme Winter Weather Events

Event Type	Number of Events	Property Damage	Crop Damage	Event Year(s)
Winter Weather	1	$ 0	$ 0	2006
Winter Storm	55	$ 3,000	$ 0	1997-1999, 2003-2010, 2012-2016, 2018-2022
Ice Storm	4	$ 0	$ 0	2001, 2002, 2005, 2008
Heavy Snow	51	$ 650,000	$ 13,000,000	1996-2009, 2011, 2012, 2014, 2016, 2018, 2020
Blizzard	6	$ 0	$ 0	1978*, 1997, 1998, 1999, 2002, 2019
Frost/Freeze	1	$ 0	$ 37,500,000	2012
Lake-Effect Snow	21	$ 0	$ 0	2006-2013, 2016, 2019
TOTAL	**139**	**$ 653,000**	**$ 50,500,000**	

Source: NOAA: National Centers for Environmental Information; MSP 2019 Michigan Hazard Analysis

Previous Occurrences
Since 1996, there have been 138 extreme winter weather events, including heavy snowstorms, lake effect snow, ice storms, frost/freeze, blizzards, and winter storms reported in Leelanau County (Table 17). Additionally, in 1978, Leelanau County, along with the rest of the state of Michigan, received a Presidential Emergency Declaration for a snowstorm and blizzard. In recent years, the more common events are winter storms with moderate snowfall of 5-10 inches. Heavy snow, blizzards, and lake-effect snows have been less common. Nonetheless, extreme winter weather events are the most frequently recorded extreme weather event with the potential to impact the entire county and cause widespread damage. With combined property and crop damages, winter weather events are also the most costly events to occur in the county.

One of the highest-impact snowstorms in recent memory pounded Northern Michigan on the night of March 2, 2012. *Low pressure tracked from Missouri, to southern Lower Michigan, and on to eastern Canada, while rapidly strengthening. Precipitation surged northward into the region on the evening of the 2nd. This was primarily snow, except in parts of east central Lower Michigan (especially near Lake Huron), where temperatures were mild enough for rain. Snow wound down on the morning of the 3rd, and though somewhat blustery winds occurred behind the system on the 3rd, blowing snow was limited because the snowfall was so wet. Snow totals ranged from 6 to 14 inches across most of Northern Michigan. Higher amounts fell near and west of Grand Traverse Bay, with a maximum amount of 20 inches near Lake Ann. With relatively warm temperatures, the snow was very wet; Traverse City saw around a foot of snow during the night, with a low temperature of 33 degrees. The snow stuck to everything, with the weight of the snow downing many, many trees and power lines. Power outages were widespread, with an outright majority of Northern Michigan residents losing power at some time during or after the storm. In Benzie County, 95 percent of residents lost power. Outages lasted up to a week in some spots. Great Lakes Energy described it as the worst snowstorm (in regards to power outages) in 30 years. A number of counties and communities opened shelters to aid those without power or heat. Also included in the tree damage was substantial damage to fruit trees in the Grand Traverse Bay region, particularly cherry trees.* This event accounts for $650,000 in reported property damages and $13,000,000 in reported crop damages.

The frost/freeze event on listed in Table 23 took place on April 27, 2012 across Northwest Lower Michigan, but especially in the Traverse City region. *A killing freeze caused extreme damage to agriculture, particularly in the fruit belt of Northwest Lower Michigan. Traverse City saw low temperatures of 25 degrees on the 27th, 31 degrees on the 28th, and 26 degrees on the 29th. These values were not exceptionally colder than normal lows, which are in the middle 30s. Ultimately, the main culprit was a stretch of unprecedented warmth in mid-March, which included five consecutive 80-degree days (17th-21st). This caused fruit trees to bud out far, far ahead of schedule, and left them vulnerable to even relatively normal weather as the spring progressed. The tart cherry crop was a total loss, while other orchard fruits such as sweet cherries, apples, pears, and peaches saw losses in excess of 90% of the expected crop. Total crop losses for the region were estimated at ten million dollars*. In Leelanau County, $37,500,000 in crop damages were reported.

Probability of Future Events and Vulnerability Assessment
Since 1996, Leelanau County has had 138 extreme winter weather events. This averages to about to about 5.5 events every year. The probability of an extreme winter weather event occurring in a future year is 100 percent. Heavy snow events have the potential of shutting down towns and businesses for a significant period of time. Blowing and drifting snow with blizzard conditions cause driving hazards. Ice damage may occur when high winds push lake water and ice past the shoreline, causing damage to public infrastructure and residential property. Leelanau County remains a leading producer of fruits, tree nuts, and berries with over $16 million in these products sold (*2017 USDA Census of Agriculture*). A frost/freeze event of the magnitude in 2012 would decimate more than three quarters of the products sold today. This would be a huge blow to an economy that is also heavily reliant on agriculture and agri-tourism (wineries, orchards, etc.).

During the winter months, the population is largely made up of the base permanent residents. However, there is increasing demand from seasonal residents to purchase property and retire or work remotely from highly desirable northern and coastal communities like those in Leelanau County. Many aspects of Leelanau County, including natural wooded areas and proximity to lakes/rivers, are attractive to prospective buyers and the permanent population is expected to continue to grow. New residents, especially those locating in remote areas, increase the chance of risk to life and property. Winter-related events cause difficult driving conditions and in the event of an emergency, can make travel increasingly difficult for emergency personnel who may be more frequently dispatched to rural areas.

Comments from April 2022 Public Input Session

- Ice dams along rivers/lakes can damage adjoining properties
- Food pantry can lose their supplies if the power is out.
- Agricultural products (vineyards, cropland) can be impacted if there is a late spring heavy frost, ice or hail storm. This can negatively impact the local agriculture economy and people's personal property.
- People who aren't aware of storm damage to their seasonal homes and return in the spring/summer to find and report damaged property (perhaps they had a roof leak or water lines that froze)

- More vulnerable residents whose homes are not well insulated could have more problems with roof damage and frozen pipes.
- 2012 storms left businesses, government and roads closed for 5 days
- Have a lack of community shelters
- Winds and ice can pull electrical lines down
- Increased potential for car accidents
- Gas stations down if they don't have back up power
- Cell towers down causes challenges with communications
- Many people rely on wood/propane fuel to heat their homes and often live in rural areas that are difficult to access in an emergency to provide their fuel source if needed.
- Population stranded on rural properties; can't be accessed by emergency vehicles with heavy/drifting snow or ice.
- Erratic winter weather patterns recently – less consistent.
- Extra burden and cost placed on the Road Commission and emergency services.
- 1977 Blizzard MSP/Corp of Engineers – road closures
- GTB Tribe added generators since the 2012 winter storms

Thunderstorms and Severe Winds

The National Weather Service defines a severe thunderstorm as: *a thunderstorm that produces a tornado, winds of at least 58 mph (50 knots or ~93 km/h), and/or hail at least 1" in diameter.* These storms can also produce lightning or heavy rain (that could cause flash flooding). Severe thunderstorms can occur at any time in Michigan, although they are most frequent during the warm spring and summer months from May through September.

High wind events are also included in this hazard category. Long-lived wind events associated with fast-moving severe thunderstorms are known as a *derecho* (pronounced similar to "deh-REY-cho"). According to the National Weather Service, a derecho is a widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to the strength of tornadoes, the damage typically is directed in one direction along a relatively straight swath. As a result, the term "*straight-line wind damage*" sometimes is used to describe derecho damage. By definition, if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho. A derecho often occurs during the spring or summer; however, it can occur any time of the year.

Severe windstorms can cause damage to homes and businesses, power lines, trees and agricultural crops, and may require temporary sheltering of individuals without power for extended periods of time.

Location
Thunderstorms and severe wind are regional events that are not confined to geographic boundaries and can affect several areas at one time with varying severity depending on factors such as elevation and wind patterns. All of Leelanau County is at risk to the occurrence and impacts from thunderstorms and severe winds.

Extent
Thunderstorms can be measured based on wind speed or damages. The average wind speed for events thunderstorm/wind and high wind or strong wind events in Leelanau County is 52 knots. There have been a total of $24,269,000 in property damages and $8,000 in reported crop damages since 1975 (Table 24).

Table 24. Thunderstorm and Wind Events

Event Type	Number of Events	Property Damage	Crop Damage	Event Year(s)
Thunderstorm Wind	50	$ 24,200,000	$ 8,000	1975, 1982, 1987, 1995, 1999, 2001-2003, 2005, 2007, 2008, 2010, 2011, 2013, 2015, 2017-2019, 2021, 2022
High Wind	12	$ 47,000	$ 0	1998, 2000, 2001, 2003, 2005, 2009, 2010, 2015, 2020, 2021
Strong Wind	3	$ 22,000	$ 0	2001, 2007
TOTAL	**65**	**$ 24,269,000**	**$ 8,000**	

Source: NOAA: National Centers for Environmental Information

Previous Occurrences
Since 1975, there have been a total of 65 thunderstorm/wind and high wind events reported in Leelanau County. This is the second most frequently occurring type of severe weather event in the county.

The most damaging event occurred on August 2, 2015. *A historic severe weather outbreak in northern Michigan, as multiple waves of severe thunderstorms crossed the region. A passing cold front would finally end the activity during the evening hours. This episode featured widespread straight-line wind damage in parts of northwest lower Michigan, and the largest hail on record in northern Michigan in Ogemaw County.* Winds speeds during this event were reported to be 78 knots. This event resulted in $18,800,000 in property damages.

Probability of Future Events and Vulnerability Assessment

Since 1975, Leelanau County has had 65 thunderstorm/wind and high wind events. This averages to 1.4 events every year. The probability of an event occurring in a future year is 100%. Damage from straight line winds usually affects multiple counties through the loss of electricity from trees/tree limbs downing power lines; causing widespread property damage; and potentially exposing the public to severe injury or fatality due to flying debris. The magnitude and severity depend on the county population, seasonal activity, and the spread of development. During the warm or summer months, the base population expands by an estimated 42% to include both the seasonal short-term population. Residents and visitors are attracted to both rural, sparsely populated rural areas and village centers. Mobile home parks and campgrounds (see Table 25), as well as institutions (schools, places of worship, etc.), and numerous annual special events that draw a large number of tourists to outdoor recreation areas were identified as specific areas of concern.

Table 25. Campgrounds and Mobile Home Communities in Leelanau County

Community	Campgrounds	RV Resort Campgrounds	Mobile Home Community
Centerville Township		Lake Leelanau RV Park	
		Leelanau Pines	
Elmwood Charter Township			"First Point: mobile home park
Empire Township	Empire Twp. Campground	Indigo Bluffs RV Park & Resort	One on the south side of Little Glen Lake
Glen Arbor Township	DH Day Campground		
	3 campgrounds on S. Manitou Island		
Leelanau Township	Leelanau State Park Campground		
Leland Township	1 campground on N. Manitou Island		
Solon Township		Paradise Cove	
Suttons Bay Township		Wild Cherry RV Resort	

Comments from April 2022 Public Input Session

- Power outages, trees down, wires down
  - Gas stations are closed; impacts commerce. Gas is needed to fuel generators!
  - Road closures due to downed trees, etc. prohibits EMS timely response to incidents; people can be stuck in their homes/neighborhoods. Also impacts local commerce if the roads are not able to be used to transport goods and services.
  - People living on oxygen or who have a low food supply or primarily perishable food supply are directly impacted
  - Glen Arbor, Peshawbestown and other areas of the County in 2015 – 5-day stretch without power after a thunderstorm. GTB had downed lines (they have a lot of overhead lines). Their sewer stations had pump failures at the main lift and had to supply generators to power them. Many negative impacts to commerce and transportation. Debris management is a cost to the county and to contract out at the State level.
  - Only have 1 power company in the County, which limits their ability to respond quickly to all outages in a wide-spread event.
  - Power outages are costly to emergency services and residents.
- Can result in big floods
- Lightning strikes can cause fires, impacting homes, woodlands
- Money and time spent on the extreme demand placed on local responders – pay overtime for increased manpower
- Leelanau County receives 1-2 events per year that meet the criteria of a severe thunderstorm, windstorm, hail, lightning, tornado… Given our seasonal influx of tourists and the high potential for these storms at the same time of the year this could have devastating impacts to the economy, infrastructure and environment.

Hail

Hailstorms occur when a severe thunderstorm produces hail that falls to the ground. Hail is formed when the updrafts of the storm carries water droplets above the freezing level, where they form into rounded or irregular lumps of ice that range from the size of a pea to the size of a grapefruit. When the weight of the hail is no longer supported by the air, it falls to the ground and has the potential to batter crops, dent automobiles, and injure people and wildlife. Sometimes, large hail appears before a tornado since it is formed in the area of a thunderstorm that tornadoes are most likely to form.

According to the 2019 Michigan Hazard Mitigation Plan, Michigan has on average 191 hail storms, an expected annual statewide loss of about $16.6 million, no deaths, and approximately 1 injury per year. Despite damaging hail occurring in every part of Michigan, the areas of the state most prone to severe thunderstorms (e.g. the Southern half of the Lower Peninsula) are also most prone to large and damaging hail. The majority of the hailstorms occur during the growing season from May through August when crops have the greatest potential to be damaged by hail.

According to the 2012 Michigan Hazard Analysis, the National Weather Service began recording hail activity in Michigan in 1967. The National Weather Service issues forecasts for severe thunderstorms with sufficient warning time to allow residents to take appropriate action to reduce the effects of hail damage to vehicles and some property. However, little can be done to prevent damage to crops. For example, during September 26-27, 1998, a line of severe thunderstorms moved across northern Lower Michigan producing hail up to 2" in diameter, destroying an estimated 30,000-35,000 bushels of apples at area farms, and damaging several homes and vehicles.

Location
Hailstorms are regional events that frequently accompany thunderstorms, and are not confined to geographic boundaries. The severity of hailstorms may range across the affected areas. All of Leelanau County is at risk to the occurrence and impacts from hailstorms. According to the National Weather Service, Leelanau County is in an area of the United States that has on average two days of hailstorm events per year.

Extent
According to the NOAA National Centers for Environmental Information, the approximate size of hail is described as follows in Table 26. If a thunderstorm produces hail that is 1 inch in diameter (quarter size) or larger, it is considered to be a severe thunderstorm.

Table 26. NOAA Hail Size Description

Appearance	Approximate Size in Inches
Pea	0.25-0.5 inch
Penny	0.75 inch
Nickel	0.88 inch
Quarter	1.00 inch (Severe)
Walnut/Ping Pong	1.50 inch
Golf Ball	1.75 inch
Hen Egg	2.00 inch
Tennis Ball	2.50 inch
Baseball	2.75 inch
Tea Cup	3.00 inch
Grapefruit	4.00 inch
Softball	4.50 inch

The greatest extent hail reported in Leelanau County was 3 inches on July 8, 2016 in Empire. According to the scale, hailstones of this size are equivalent to a tea cup. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people. Hailstorms have caused no deaths or injuries, $85,000 in property damages and $3,055,000 in crop damages in Leelanau County.

Previous Occurrences
Between 1998 and 2022, Leelanau County had 35 hailstorms reported to NOAA (Table 27).

Table 27: Hail Events, 1998-2022

BEGIN LOCATION	BEGIN DATE	MAGNITUDE
SUTTONS BAY	6/24/1998	0.75
LELAND	5/12/2000	1
SUTTONS BAY	5/12/2000	1
MAPLE CITY	5/12/2000	1
NORTHPORT	6/9/2000	0.88
LELAND	5/15/2001	1
SUTTONS BAY	5/15/2001	1.75
SUTTONS BAY	5/15/2001	1
LELAND	5/30/2002	0.75
GREILICKVILLE	8/28/2003	0.88
LELAND	6/13/2004	1
GLEN HAVEN	8/9/2004	0.75
CEDAR	9/7/2005	0.88
LELAND	7/17/2006	1
EMPIRE ARPT	10/18/2007	1
EMPIRE	6/15/2008	0.88
HATCHS	6/15/2008	1
CEDAR	7/2/2008	0.88
SUTTONS BAY	7/2/2008	0.75
LELAND	9/7/2008	0.88
SUTTONS BAY	4/25/2009	0.75
MAPLE CITY	4/10/2011	0.88
EMPIRE	4/10/2011	1
MAPLE CITY	4/10/2011	1
LAKE LEELANAU	6/8/2011	1
SUTTONS BAY	6/8/2011	0.88
GREILICKVILLE	5/20/2013	1
NORTHPORT	5/20/2013	1
NORTHPORT	8/30/2013	1.5
LAKE LEELANAU	8/2/2015	1
EMPIRE	7/8/2016	3
BOCUS	7/8/2016	1.5
SUTTONS BAY	7/8/2016	1
LELAND	4/10/2017	0.88
GREILICKVILLE	8/10/2021	0.75

Source: NOAA: National Centers for Environmental Information

During one particularly strong event on July 17, 2006, hail damage was significant within Leelanau County and the region. A strong cold front ran headlong into warm and humid air in place over Michigan. Thunderstorms ignited by midday in Eastern Upper Michigan, and became widespread by late afternoon in Northern Lower Michigan. A large number of storms became severe, as this became the largest severe weather outbreak in Northern Michigan in several years. Millions of pounds of fruit crops were destroyed by hail and wind. The reported hail size in Kewadin was 1", roughly the size of a quarter.

Another strong event occurred on July 8, 2016 in Empire and Glen Arbor Township. Powerful thunderstorms developed over Lake Michigan late in morning of the 8th, ahead of an incoming cold front. These storms produced very large hail, and some damaging winds, as they swept across northern Michigan. Approximately 60 percent of the cherry crop in northwest lower Michigan was damaged by the severe thunderstorms. Golf ball-sized hail was reported in Empire, and up to three inches in diameter in Glen Arbor. Some vehicles were damaged, and a few homes lost windows and skylights. Considerable damage was done to orchards and vineyards in the area.

Probability of Future Events and Vulnerability Assessment

With 35 events reported in the past 25 years, Leelanau County has a 100% chance of a hailstorm every year. All existing and future buildings, exposed infrastructure, and populations are at risk from hailstorms since hail causes damage to roofs, brick walls, glass, landscaping, crops, and cars. Manufactured homes and campground populations located throughout the county and are more susceptible to hail damage (refer to Table 25). Hail can also damage roads, sidewalks, bridges, and above ground utilities. Hail has the potential to cause injury and death, and populations are advised to take shelter when an event occurs.

Riverine and Urban Flooding

Fluvial, or Riverine flooding occurs when rivers, streams, and lakes overflow into adjacent floodplains due to prolonged, intense rainfall, rapid snowmelt or ice jams. Flooding can damage or destroy property, disable utilities, destroy crops and agricultural lands, make roads and bridges impassable, and cause public health and safety concerns. Floods occur in the early spring, but also occur in the winter due to ice jams, and during the summer or fall from severe thunderstorms. Flooding caused by severe thunderstorms has a greater impact on watercourses with smaller drainage areas.

Pluvial, or *Urban, flooding* occurs when water flows into low-lying areas because it does not have a place to go, due to impervious surface coverage. This flooding occurs from a combination of excessive rainfall, snowmelt, saturated ground, and inadequate drainage, and is becoming more common in Michigan. Since development is occurring in floodplains, the natural landscape is unable to properly disperse the water. Urban flooding also has the potential to overflow onto docks or other structures with electricity running to them, which increases the risk for an electric shock drowning. Additionally, storm and sanitary sewers are unable to handle the water flows associated with storm events, which can result in sewer overflows and affect the water quality of nearby lakes and rivers, as well as structures with basements or shallow groundwater tables.

Dam failure is also a potential source of flooding. Infrastructure in the state is aging and costly to maintain. FEMA provides Federal Guidelines for Dam Safety. These guidelines encourage strict safety standards in the practices and procedures employed by federal agencies or required of dam owners regulated by the federal agencies (2004). The National Inventory of Dams provides a catalogue of dams in the nation with a profile of each. Each profile lists the Hazard Potential Classification. This is a system that categorizes dams according to the degree of adverse incremental consequences of a failure or mis-operation of a dam. The hazard potential classification does not reflect in any way on the current condition of the dam. Three classification levels are adopted as follows: Low, Significant, and High, listed in order of increasing adverse incremental consequences.

According to the 2019 Michigan Hazard Analysis, the most damaging hazard in Michigan, based upon estimated physical damages and known response/recovery costs, appears to be floods. The MSP reports that flooding events have a statewide expected annual loss estimated at more than $100 million ($25.69 million had previously been estimated in the 2014 Michigan Hazard Mitigation Plan, but Federal Disaster 4195 confirmed a higher magnitude more in line with earlier EGLE estimates, as that Metro Detroit flood event was quite similar to Federal Disaster 1346 during the previous decade).

The MSP's 2019 Michigan Hazard Analysis indicates that the Northern Lower Peninsula averages 0.3 annual flooding events, with average annual property and crop damages of $2,591,244 due to flooding.

Location

Urbanized areas or areas with higher concentrations of impervious surface and low –lying areas are most likely to flood in Leelanau County. Heavy rainfall can oftentimes overwhelm a city stormwater system causing backups and ponding or flooding. The Village of Suttons Bay and the Village of Northport have experienced significant flooding in the past. The County's hilly terrain will cause water to cascade oftentimes bringing sediment with it. Water and sediment will congregate in the low lying areas. Enough rain will cause erosion of the road bed and eventually cause road washouts. Cherry Bend Rd, Tumble Rd, and N West Bay Shore Drive have been known to flood.

According to the National Inventory of Dams, Leelanau County has four major dams listed including: Belanger Dam, Cedar Lake Dam, Leland Dam, and Meeuwenberg Dam (Table 28, Figure 13). The Belanger Dam has a Hazard Potential Classification of "Low". Low hazard potential dams are not required to have an Emergency Action Plan on file with the State of Michigan/ Leelanau County Emergency Management. Additionally, there is no expected loss of human life or impact to lifeline interests if the dam were to fail, and economic losses and environmental damages would be low and generally limited to that of the dam owner.

The three remaining dams: Cedar Lake Dam, Leland Dam, and Meeuwenberg Dam have a higher Hazard Potential Classification of "Significant" and "High." "Significant" means that if the dam were to fail, there would be economic losses, environmental damages, and impacts to lifeline interests, but no expected loss of human life. "High" means that if the dam were to fail, there would be economic losses, environmental damages, impacts to lifeline interests, and probably cause loss of human life.

- The owner/operator of the Cedar Lake Dam is Elmwood Township. According to the Michigan Dam Inventory, it was last inspected October 11, 2021, receiving a "Satisfactory" condition rating, and is due for inspection again by December 30, 2025. It is listed as having an Emergency Action Plan on file as of March 14, 2001.

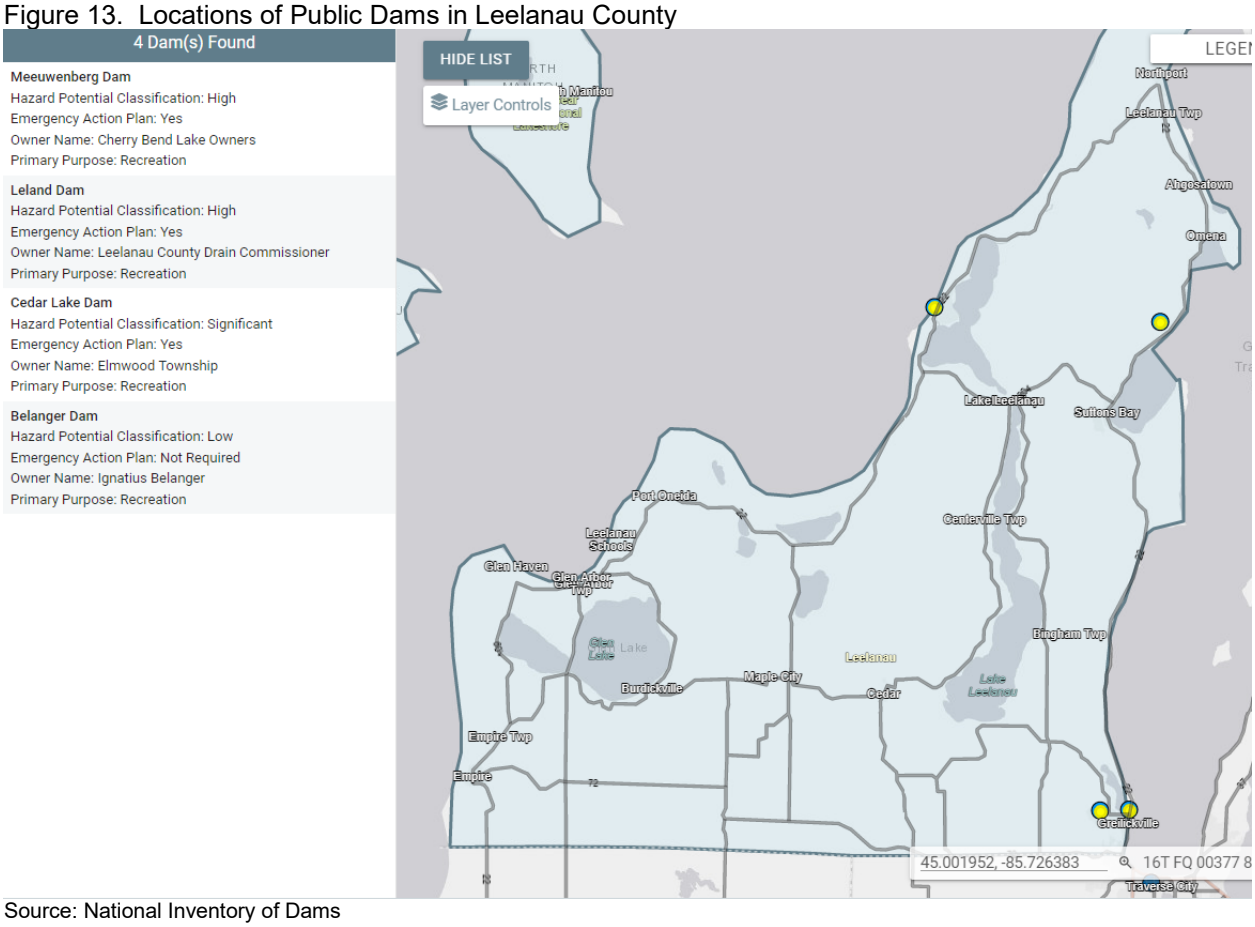
- The owner/operator of the Leland Dam is the Leelanau County Drain Commission. According to the Michigan Dam Inventory, it was inspected on September 29, 2019, inspected again on September 1, 2022, report dated October 2022, and received a "Satisfactory" condition rating. It is listed as having an Emergency Action Plan on file.
- The owner/operator of the Meeuwenberg Dam is the Cherry Bend Lake Owners. According to the Michigan Dam Inventory, it was last inspected August 11, 2019, receiving a "Satisfactory" condition rating, and is due for inspection again by December 30, 2022. It is listed as having an Emergency Action Plan on file as of January 5, 2011.

Table 28. Public Dams in Leelanau County

Name	Height (Ft)	Storage (Acre-Ft)	Location	City/Township	Owner	Year Completed	Hazard Potential
Belanger Dam	21	50	Belanger Creek	Peshawbestown (Suttons Bay Township)	Ignatius Belanger	1864	Low
Cedar Lake Dam	16	1,600	Cedar Lake Outlet	Elmwood Township	Elmwood Township	1856	Significant
Leland Dam	19	86,950	Lake Michigan Tributary	Leland Township	Leelanau County Drain Commission	1910	High
Meeuwenberg Dam	42	193	Cedar Lake Tributary	Elmwood Township	Cherry Bend Lake Owners	1968	High

Source: National Inventory of Dams

Figure 13. Locations of Public Dams in Leelanau County



Source: National Inventory of Dams

Extent
Flood extent can be measured by the amount of property damage and accumulation of rainfall. There have been four (4) flood events in Leelanau County (Table 29). In total, flood and flash flood events have caused $50,000 in property damages, no crop damages, and no deaths or injuries. Since 2000, the average annual precipitation is 34.18 inches. October is historically the wettest month with an average of 4.27 inches.

Table 29. Leelanau County Fluvial and Pluvial Flood Events

LOCATION	DATE	EVENT TYPE	PROPERTY DAMAGE	CROP DAMAGE	FLOOD CAUSE
COUNTYWIDE	7/6/1999	Flash Flood	$ 0	$ 0	Heavy Rain
COUNTYWIDE	9/1/2000	Flash Flood	$50,000	$ 0	Heavy Rain
EMPIRE	8/10/2021	Flash Flood	$ 0	$ 0	Heavy Rain
SOLON	8/10/2021	Flash Flood	$ 0	$ 0	Heavy Rain

Source: NOAA: National Centers for Environmental Information

Previous Occurrences
Leelanau County has experienced four flash flood events. The event narrative as reported in the NOAA NCEI database for the flash flood event on September 1, 2000 is as follows:

Thunderstorms formed along a warm front that stretched across northern Lower Michigan. The first thunderstorms began in Leelanau County around 400 pm and intensified quickly over the next hour. One thunderstorm intensified west of Traverse City and quickly moved over the downtown area. As the storm moved east of the city, a 60 MPH wind gust was reported, followed by a report of one inch diameter hail. Meanwhile, more storms producing very heavy rainfall formed over Lake Michigan and continued to dump rain over Leelanau county, mainly to the south of Leland and Suttons Bay, as well as over the Traverse City metropolitan area. The rain lasted over these locations from 600 pm to 1130 pm. Another area of thunderstorms formed over northern Benzie county around 700 pm. These also moved into the Traverse City metropolitan area. As with the storms over Leelanau county, these storms persisted until 1130 pm, continually affecting the same areas. Over the 4 to 5 hour period of rainfall, much of Leelanau county reported rainfall amounts ranging from 4 to 8 inches, while amounts ranged from 2 to 6 inches in Benzie and Grand Traverse counties.

These storms led to flooding across Leelanau county as well as the northern half of Benzie and Grand Traverse counties. Many secondary roadways across the central and western sections of Leelanau county were washed out. Sections of M-22 running near Suttons Bay received significant damage due to the force of the running water. Several businesses within the town of Glen Arbor were flooded. Many city streets around Traverse City became inundated with as much as 4 feet of standing water. Intense lightning also occurred with these storms. The lightning caused power outages to hundreds of homes and businesses in the Traverse City area.

Probability of Future Events and Vulnerability Assessment
Since 1999, Leelanau County has had 4 flash flooding events. This equates to a 16.7% annual chance of a flash flood. The magnitude and severity depend on the county population, seasonal activity, and the spread of development. During the warm or summer months, the population expands to include both the permanent resident base population and the seasonal short- and long-term population. The seasonal population is attracted to both rural, sparsely populated rural areas and urban activity centers. Downtown Traverse City is also the epicenter for festivals and events such as the National Cherry Festival which takes place mid-summer over the Fourth of July holiday. While Downtown and much of the city is located in Grand Traverse County, many visitors stay in Leelanau County and commute to the city for events.

Floods can damage or destroy public and private property, disable utilities, make roads and bridges impassable, destroy crops and agricultural lands, cause disruption to emergency services, and result in fatalities. People may be stranded in their homes for several days without power or heat, or they may be unable to reach their homes at all. Long-term collateral dangers include the outbreak of disease, widespread animal death, broken sewer lines causing water supply pollution, downed power lines, broken gas lines, fires, and the release of hazardous materials.

The seasonal nature of flooding will continue to occur. Years with exceptional snowfall levels will likely result in flooding events from snowmelt. Lake Michigan water temperatures will create more active storm systems and heavier rainfalls. Lake Michigan water levels will also increase flooding events inland as the water table rises. Furthermore, increased development, reduction in green space, and subsequent soil erosion cause sedimentation to accumulate in river and lake beds reduce the amount of water flow. Rivers and lakes with sedimentation buildup will experience water backups and flooding events unless mitigated.

Members of the task force identified the following sites for concern:

- The Belanger Creek Dam and road/stream crossing (at the end of Belanger Creek at the intersection with M-22) located in Peshawbestown
- Belanger Creek, located southeast of Stallman Road to the outlet in the Bay – potential for overflow
- Stallman Road near the intersection with Belanger Creek, located SW of Strongheart Way.

Specific flood hazard areas were identified during public meetings and are identified on the Hazard Areas Map provided in Appendix A. Areas that are particularly vulnerable to flooding are areas adjacent to inland lakes (areas surrounding Lake Leelanau: Solon Township, Elmwood Township, Centerville Township, and Bingham Township), wetland areas (north of Glen Lake: Glen Arbor Township), and other generally recognized flood zone areas (Cleveland Township and Leelanau Township). Flood zone hazard information may be obtained from the Flood Rate Insurance Maps (FIRM) available for jurisdictions and included on the Environmental Features Map in Appendix A.

Additionally, the Infrastructure Map included in Appendix A illustrates the locations of road/stream crossings, bridges and dams with their currently available condition rating. The Townships of Bingham, Elmwood, Leelanau and Suttons Bay have road/stream crossings that are rated as having a moderate or severe condition.

NFIP Participation Status

Leelanau County communities participating in the National Flood Insurance Program (Table 28) received an updated Flood Insurance Study and digital flood maps in 2018. In light of the changing flood potential in surrounding counties and Leelanau County, the County Drain Commissioner has been in contact with FEMA to review existing flood concerns in the county. Community input and coordination with FEMA will determine the extent, if any, of future mapped flood areas.

FEMA defines a "repetitive loss property" as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period since 1978 (the year at which consistent claims data collection began). Twelve claims have been paid since 1978 (Table 30). County officials have not identified any property(ies) that are defined by the National Flood Insurance Program as having suffered repetitive flood losses. FEMA officials were contacted in July 2022, with a request to provide documentation of NFIP data. The documentation was not provided prior to the completion of this plan. The *2019 Michigan Hazard Analysis*, completed by the Michigan State Police provides the following National Flood Insurance statistics for Leelanau County:

Table 30. National Flood Insurance Statistics

Total Premium	Policies	A-Zone Policies	Total Coverage	Claims since 1978	Total Paid Since 1978
$78,534	69	43	$18,236,300	12	$20,104

Source: MSP 2019 *Michigan Hazard Analysis*

Table 31: Leelanau County NFIP Participation

Municipality	Community ID #	Initial FIRM Issued	Current Effective Map Date
City of Traverse City	260082B	12/15/1982	06/07/2023
Village of Empire	260605B	08/28/2018	06/07/2023
Village of Northport	260580B	03/02/1989	06/07/2023
Village of Suttons Bay	260283B	06/01/1977	06/07/2023
Bingham Township	260772B	08/28/2018	06/07/2023
Centerville Township	260625B	02/01/1986	06/07/2023
Cleveland Township	260302B	09/01/1986	06/07/2023
Elmwood Charter Township	260113B	02/02/1983	06/07/2023
Empire Township	260765B	08/28/2018	06/07/2023
Glen Arbor Township	260604B	09/01/1986	06/07/2023
Kasson Township	No Special Flood Hazard Areas	None issued	Not in the NFIP
Leelanau Township	260114B	04/02/1986	06/07/2023
Leland Township	260760B	08/28/2018	06/07/2023
Solon Township	261510B	08/28/2018	08/28/2018
Suttons Bay Township	260770B	08/28/2018	06/07/2023

Source: FEMA Community Status Book Report

Leelanau County communities participating in the NFIP (Table 31) have designated the Leelanau County Construction Codes Office as the “appointed designee” to implement the commitments and requirements of the NFIP. The local zoning codes of each NFIP participating community require that all required, approved permits must be received regarding compliance with floodplain regulations prior to approval of a site plan. Additionally, the Leelanau County Soil Conservation Office administers the County’s Soil Erosion, Sedimentation and Stormwater Runoff Control (SESSRC) Ordinance. One of the many requirements of the ordinance is to not permit the grading of land or other earth changes shall in any floodplain unless approved by the Michigan Department of Environment, Great Lakes, and Energy as well as the Soil Erosion Control Officer.

Lightning

Lightning is a random and unpredictable discharge of electricity in the atmosphere between the clouds, air, or ground to equalize the charged regions in the atmosphere. It is still being debated how the electrical charges build up in the clouds. Lightning generally occurs during thunderstorms; however, it can occur without a thunderstorm, such as during intense forest fires and heavy snowstorms. Lightning that occurs without nearby rain is most likely to cause forest fires.

Location
Lightning is not confined to geographic boundaries and is a regional event. Since lightning occurs randomly, it is impossible to predict where lightning will occur and how severe it will be. All of Leelanau County is at risk to the occurrence and impacts from lightning.

Extent
Lightning can be measured by damages it has caused, such as deaths, injuries, property damages, and/or crop damages. Since 1996, two lightning events have been reported to NOAA for Leelanau County. Those events have caused $40,000 in property damage, no crop damages, no injuries, and no fatalities.

Previous Occurrences
There have been two lightning strikes reported to NOAA since 2000. There have been no fatalities. There have been no other reports of damages or injuries from lightning. Table 32 is a record of lightning events in Leelanau County.

The event narrative of August 12, 2007 is as follows:

A small cluster of thunderstorms produced severe weather in Leelanau County. A lightning strike ignited a fire, which destroyed a three-car garage and a boat that was inside, and melted vinyl siding on an adjacent home.

Lightning from the event on September 1, 2000 caused a fatality and an injury in Grand Traverse County. A man and his son were struck by lightning when they climbed a hill to view the approaching lightning. Lightning also caused delays in numerous high school football games.

Table 32. Lightning Events

LOCATION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE
County/Region	9/1/2000	0	0	$0
Solon Township	8/12/2007	0	0	$40,000
TOTAL		**0**	**0**	**$40,000**

Source: NOAA: National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment
Since there have been two lightning events reported in the last 23 years, the data shows that there is an 8.7% chance a lightning strike would occur in a given year. However, not all lightning events may have been reported since events with injuries, deaths, and extensive damages tend to be the only ones reported. Therefore, the number of lightning events and damages may be higher.

All existing and future buildings, exposed infrastructure, and populations are at risk from lightning events since it may cause structural and wildland fires, loss of electrical and telecommunications equipment, and damage to buildings or vehicles from falling trees struck by lightning. People that work outside or participate in outdoor recreation activities are at a higher risk to be struck by lightning. Every community in the County has a variety of outdoor recreation areas. Additionally, refer to Table 25 in this plan for a list of campgrounds in the county.

Tornado

Tornadoes are rapidly rotating columns of air that impact the ground after forming from some of the severe thunderstorms that occur during Michigan's warm months. Tornadoes can cause catastrophic damage to either a limited or an extensive area. A tornado can have winds exceeding 200 miles per hour and can have widths over one mile. These storms are the most violent of the atmospheric storms since they have the potential to destroy buildings, uproot trees, hurl objects, and cause loss of life.

According to the National Oceanic and Atmospheric Administration/National Weather Service's Storm Prediction Center, tornadoes cause approximately 60 deaths and hundreds of millions of dollars in property damage each year. The Michigan State Police's *2019 Michigan Hazards Analysis*, Michigan is located on the northern fringe of the nation's tornado belt, and since 1996 has averaged about 18 tornadoes per year. The longer term annual average (since 1950) is 8 injuries and one death per year, and over $17 million in property damages statewide.

Between 1999 and 2019, Michigan has had 314 reported tornado events with 52.9% as EF0 (weak) or EF1 (moderate), 38.9% reported as F0 or F1 (weak), 6.7% as EF2 (significant) or EF3 (severe), and 1.6% as F2 (strong). In Northern Michigan, tornados are most likely in the summer months, although some have occurred in the spring and fall.

Location
Tornadoes are a regional event that are not confined to geographic boundaries and can affect several areas at one time. Also, the magnitude of tornadoes may range across the affected areas. All of Leelanau County is at risk to the occurrence and impacts from tornadoes. It is impossible to predict where and with what magnitude a tornado will touch down. Approximate trajectories of recorded tornadoes with NOAA are illustrated on the Vulnerable Populations and Hazard Areas Map in Appendix A.

Extent
The Fujita Scale (Table 33) categorizes tornado severity based on observed damage. The six-step scale ranges from F0 (light damage) to F5 (incredible damage). As of February 2007, the National Weather Service uses the Enhanced Fujita Scale (EF Scale). This new scale ranges from EF0 to EF5. Based on the Fujita Scale, Leelanau County's most damaging tornado occurred on August 15, 1978; wind speeds are unknown. It caused no injuries or deaths, but $ 250,000 in property damages.

Table 33. Fujita and Enhanced Fujita Scale Comparison

Fujita Scale		EF Scale	
Fujita Scale	**3-Second Gust Speed (mph)**	**EF Scale**	**3-Second Gust Speed (mph)**
F0	45-78	EF0	65-85
F1	79-117	EF1	86-109
F2	118-161	EF2	110-137
F3	162-209	EF3	138-167
F4	210-261	EF4	168-199
F5	262-317	EF5	200-234

Source: FEMA

Previous Occurrences
Between 1977 and 2022, Leelanau County has had three reported tornadoes touch down, causing a reported $ 295,000 in property damage (Table 34). As a result of these tornadoes, there were no deaths, no injuries, and no reported crop damage. The tornado event on August 15, 1978 caused $250,000 in damage, the most destructive of the three. The tornado touched down in Suttons Bay Township and proceeded northeast into Peshawbestown across E. McKeese Road.

The event narrative is as follows:

A tornado touched down on M-22, south of Leland, and skipped ENE damaging four homes and two mobile homes and blocking roads with felled trees. Most of the damaged homes were on Dumas Road. Many small boats on Lake Leelanau broke loose from their moorings with several sail boats capsizing.

Table 34. Tornado Events

BEGIN LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE
Glen Arbor Township	7/31/1977	F1	0	0	$25,000
Suttons Bay Township	8/15/1978		0	0	$250,000
Leland Township	6/22/2011	EF0	0	0	$20,000
TOTAL			**0**	**0**	**$295,000**

Source: NOAA: National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment

Since there have been three tornadoes events reported in the last 46 years, the data shows that there is a 6.5% chance a tornado would occur in a future year. While the chance for a tornado is low, if an event occurs, there is potential for a higher magnitude tornado to touch down. All reported historic events have caused significant property damage. Due to increased residential growth in the county, the chances of a tornado touching down and causing residential damage is very high, especially in Traverse City and surrounding townships where population densities are highest. Persons with a disability, elderly persons, and those in campgrounds and mobile homes (see Table 25) are also more vulnerable. Tornados can occur suddenly with very little warning, and it may be difficult for these populations to find adequate shelter in a hurry.

The Grand Traverse Band Tribe of Ottawa and Chippewa Indians maintains two underground tornado shelters on tribal property in Suttons Bay Township. Completed in 2008, each shelter can accommodate up to 32 individuals and their pets and belongings. The prefabricated underground shelters were designed and installed for the safety and protection of tribal residents without basements in their homes ruing severe storms and tornados. The shelters are open during the severe weather months (April – September) and are locked during the late fall and winter months.

The county currently utilizes the "*Rave*" mass notification system for notification of tornado warnings and watches, along with other severe weather alerts. The system notifies a participant via their mobile or land-line phone. The National Weather Service may concurrently utilize their notification system when deemed necessary in severe weather event situations to send phone notifications to all users within signal of a cellular tower. Additionally, there are warning sirens located at each fire station (Suttons Bay, Leland, Elmwood, Northport, Cedar, Glen Lake, and Peshawbestown at the Pow Wow Grounds) that are operable for tornado warnings.

Leelanau County Office of Emergency Management maintains contracts with six local fire stations and seven other facilities in the county so that they may be utilized as temporary shelters in the event of an emergency. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan. Additionally, the American Red Cross can set up temporary shelters within 12-24 hours after an emergency event occurs; usually this is done within an existing structure. Private and religious facilities, as well as local libraries, have been utilized during regular hours for temporary shelters to be used during the day. There are no homeless shelters located within Leelanau County.

Extreme Temperatures

Prolonged periods of very high or very low temperatures are often accompanied by other extreme meteorological conditions, such as high humidity, drought, heavy snowfall, or high winds. Extreme heat or extreme cold primarily affect the most vulnerable segments of the population, such as the elderly, children, impoverished individuals, and people in poor health.

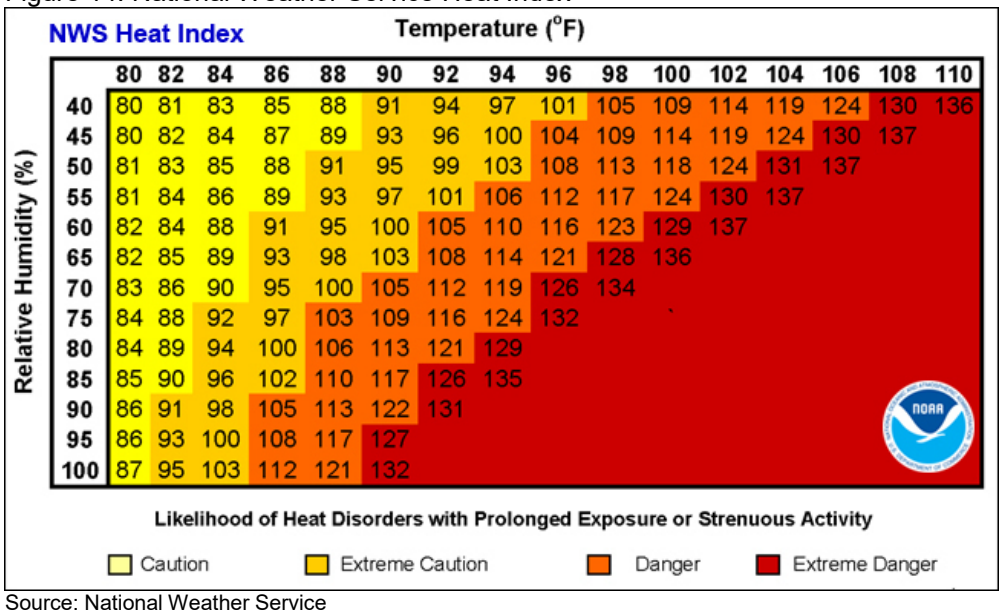
Nationwide, there have been approximately 175 deaths per year that are attributable to extreme heat according to the 2019 Michigan Hazard Analysis. The threats from extreme heat are heatstroke, sunstroke, muscle cramps, heat exhaustion, and fatigue. It is hazardous to livestock and agricultural crops, causes water shortages, exacerbates fire hazards, exacerbates respiratory problems, prompts excessive electrical energy demands, and causes infrastructure failures. Urban areas experience the most serious extreme heat with the combined high temperatures and high humidity that produce a heat-island effect.

According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 11 average annual extreme heat events with 0.4 average annual deaths and 41 average annual injuries.

In the United States, approximately 700 people die each year as a result of severe cold temperature-related causes according to the 2019 Michigan Hazard Analysis, with a significant number of deaths occurring due to illnesses or disease that are negatively impacted by severe cold weather, such as stroke, heart disease, and pneumonia. Exposure to extreme cold temperatures can be life threatening and can cause hypothermia and frostbite. According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 35 average annual extreme cold events with 1 death, 9.4 average annual injuries, and $6.4 million in average annual property and crop damage. Extreme cold affects transportation modes and power utilities, resulting in dead vehicle batteries and loss of power/heat.

Measuring Extreme Temperatures (Extreme Heat and Extreme Cold)
Extreme heat is measured with the National Weather Service's Heat Index Chart (Figure 14). The chart uses relative humidity and air temperature to determine the likelihood of heat disorders with prolonged exposure or strenuous activity. Individuals are unable to shed excess heat from their bodies when they experience prolonged exposure to hot temperatures, which results in heat disorders.

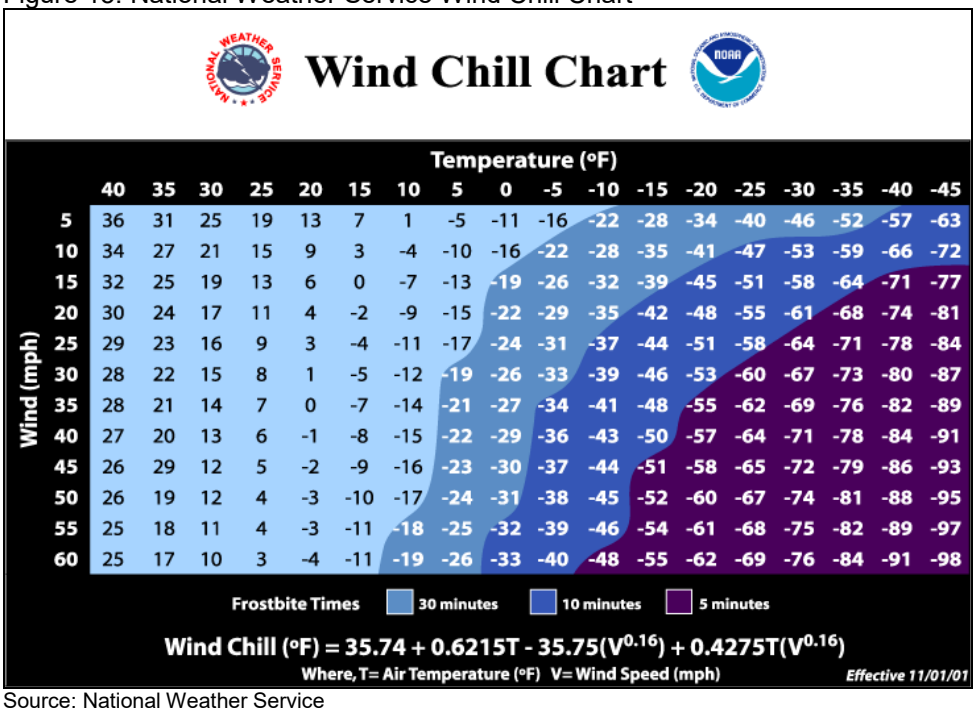
Figure 14: National Weather Service Heat Index



Source: National Weather Service

Extreme cold is measured with the wind chill index, which is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body and reduces the external and internal body temperatures. Figure 15 shows the NOAA Wind Chill Chart as it corresponds to various temperatures and wind speeds.

Figure 15: National Weather Service Wind Chill Chart



Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

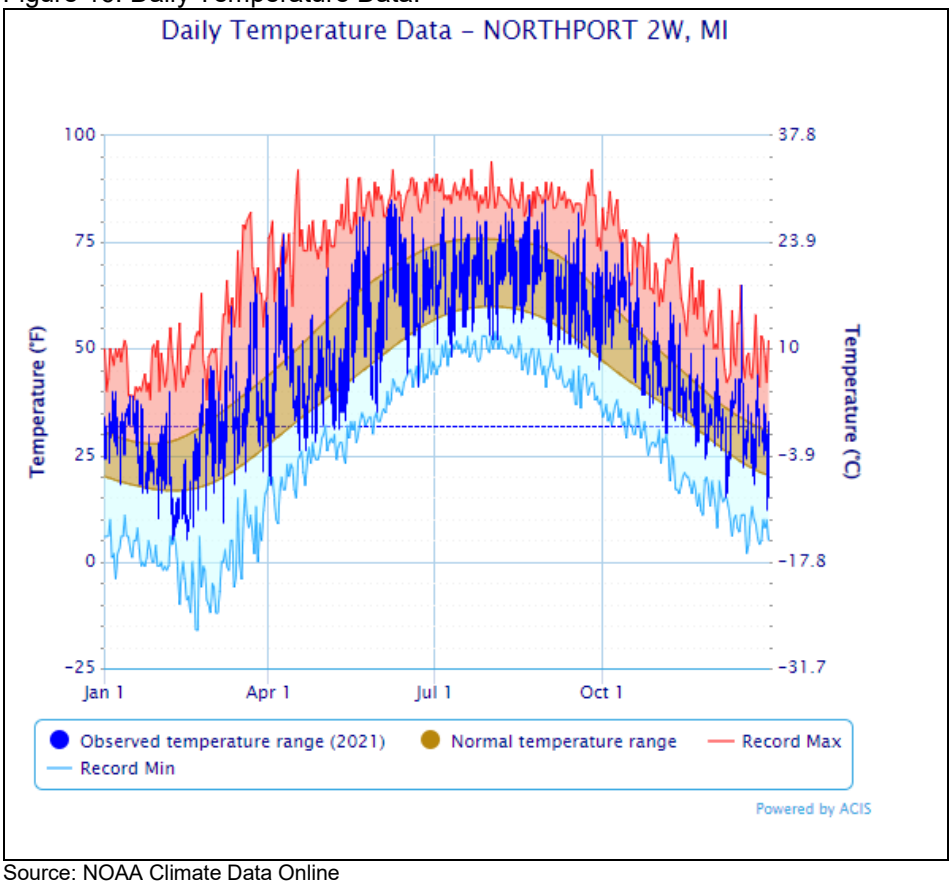
Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Source: National Weather Service

Figure 16 illustrates the observed temperatures in Northport for 2021. The dark blue line shows temperatures recorded between January 1 2021 and December 21, 2021. The red line above shows record high temperatures for that day, and the light blue line below indicates record low temperatures for that day.

Figure 16: Daily Temperature Data:



Source: NOAA Climate Data Online

Location and Extent
Extreme temperatures are a regional event that are not confined to geographic boundaries and range in severity across the affected areas. All of Leelanau County is at risk to the occurrence and impacts from extreme temperatures.

Previous Occurrences
Leelanau County has had two extreme heat events in 2001 and 2018 (Table 35). The events did not have any deaths, injuries, or property/crop damages. The events consisted of hot and humid conditions that caused outdoor events to be modified and attendance at outdoor events to be lower than normal.

Table 35. Heat Related Events

	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
LEELANAU (ZONE)	8/1/2001	Heat	0	Excessive Heat was also a problem the first two weeks in August across all of northern Michigan. Temperatures reach the mid to upper 90s, on average, a few days each year; however, for a 5 day (8/5 - 8/9) stretch overnight low temperatures failed to fall below the lower 70s in most areas.
LEELANAU (ZONE)	6/30/2018	Excessive Heat	0	Highs were well into the 90s, including 98 at Traverse City and Gaylord. The National Weather Service office near Gaylord also hit 98; that was (by several degrees) the warmest reading recorded at that location since observations began there in the late 1990s.

Source: NOAA: National Centers for Environmental Information

Since 2000, there have been three extreme cold events reported in Leelanau County (Table 36). There was one death, no injuries, and no property/crop damages. The low temperatures caused schools to close. However, since cold temperatures typically occur during winter months, many events may have gone unrecorded.

Governor Declared Emergency for extreme cold in the State was enacted in 2019 and included Leelanau County.

Table 36. Cold Related Events

	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
LEELANAU (ZONE)	2/4/2007	Extreme Cold/wind chill	0	High temperatures on the 4th (Super Bowl Sunday) were around zero, with low temperatures that night from five to ten below zero. Gusty northwest winds produced hazardous wind chills of 20 to 30 below zero, along with blowing and drifting snow. Many area schools closed on the 5th, due to the extreme cold and poor road conditions.
LEELANAU (ZONE)	2/10/2008	Extreme Cold/wind chill	1	Polar air surged into the region behind the departing system, dropping temperatures to around zero. Lake effect and lake enhanced snow quickly developed, with a widespread two to five inches in the snowbelts. There were isolated higher amounts of seven inches in Gaylord, nearly nine inches south of Traverse City, and eight inches near Trout Lake. Wind gusts up to 45 mph, when combined with falling and blowing snow, produced outright blizzard conditions in the open country of central Chippewa County, and near blizzard conditions at times across much of the rest of Northern Michigan. In Leland, an 87-year-old male Alzheimers patient was found dead five blocks from his home on the morning of the 10th. Local law enforcement stated he died of exposure to the cold. A number of area schools were closed on the 11th (Monday) as the clean-up was still underway.
LEELANAU (ZONE)	1/29/2019	Extreme Cold/wind chill	0	Governor Declared Emergency – Wind chills of 15 to 30 below zero were common in northern lower Michigan. Wind chills were much colder in eastern upper Michigan, including -51 at Kinross, and -42 at Sault Ste Marie and Mackinac Island.

Source: NOAA: National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment

There have been two extreme heat events on record with NOAA in Leelanau County over the past 22 years: one in 2001 and one 2018. This indicates that there is 9% chance of another extreme heat occurring in a given year.

There have been three extreme cold events on record affecting the County since 2007. This indicates that there is an 18.75% chance an extreme cold event would occur in a future year. However, since extreme cold events tend to occur during the winter months and are coupled with blustery winds and snowstorms, these events may have been reported as other hazards or not at all, which means there may have been more extreme cold events in the county.

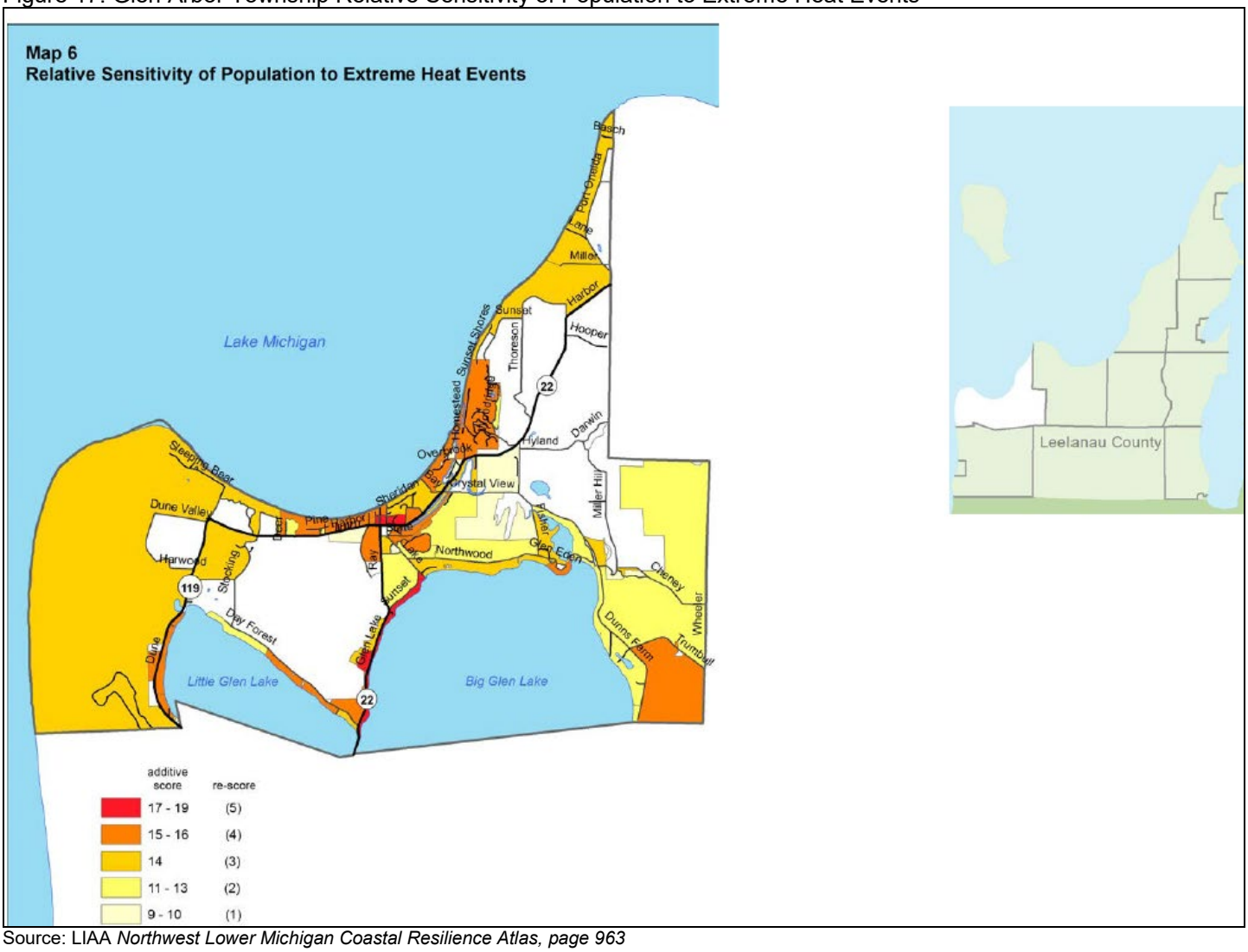
Extreme heat and cold events are more likely to impact unsheltered populations. Traverse City's homeless population is especially vulnerable. Seasonal Emergency Shelters such as Safe Harbor (Grand Traverse County) are essential services for the community. Also, Leelanau County Office of Emergency Management maintains contracts with six local fire stations and seven other facilities in the county so that they may be utilized as temporary heating or cooling shelters in the event of an extreme heat or extreme cold emergency. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan.

Additionally, the *Northwest Lower Michigan Coastal Resilience Atlas,* written by the Land Information Access Association (LIAA), completed a Heat Vulnerability Assessment[4] of coastal communities. A community's vulnerability is their exposure to the hazard (determined by tree canopy and impervious surface coverage) + their sensitivity. Sensitivity is determined by the folowing factors:

- Persons > 65 years
- Persons living alone
- Minority (non-white) persons
- Persons living below the poverty threshold
- People > age 25 with less than a high school education
- Disability status (i.e., ambulatory difficulty, mental disability)

Glen Arbor Township has the highest median age (65.5) of all Leelanau County communities. Their relative sensitivity to extreme heat events is pictured in Figure 17.

Figure 17. Glen Arbor Township Relative Sensitivity of Population to Extreme Heat Events



Source: LIAA *Northwest Lower Michigan Coastal Resilience Atlas, page 963*

[4] Land Information Access Association. (2019). *Northwest Lower Michigan Coastal Resilience Atlas.* http://www.resilientmichigan.org/nw_atlas.asp

Drought

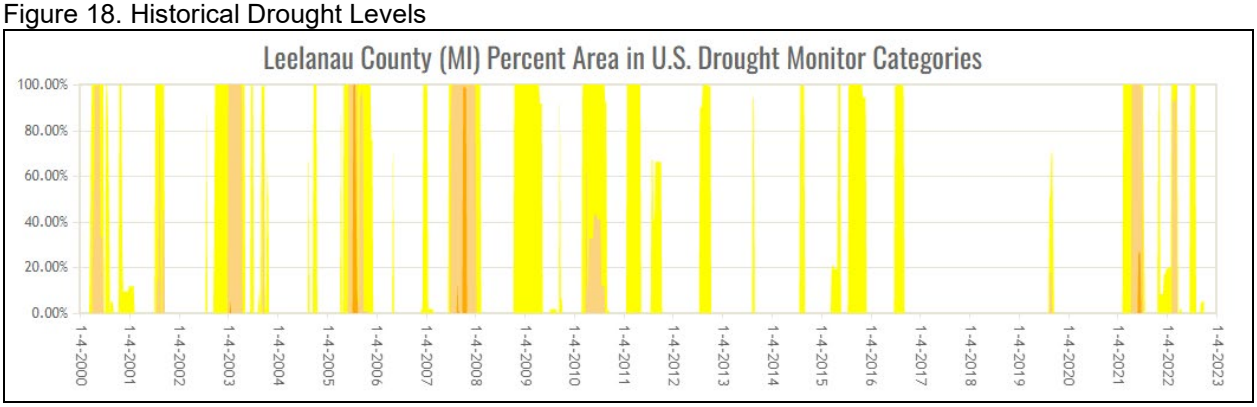
Drought is a normal part of the climate cycle. It is a slow-moving hazard, which causes people to underestimate the damage it can do, but losses from drought are as substantial as those from hurricanes, tornadoes and other faster-moving disasters. Drought causes losses to agriculture; affects domestic water supply, energy production, public health, and wildlife; and contributes to wildfire, to name a few of its effects.

Location
Drought is a regional event that is not confined to geographic boundaries and range in severity across the affected areas. All of Leelanau County is at risk to the occurrence and impacts from drought.

Extent
The Palmer Drought Severity Index (PDSI) uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that generally spans -10 (dry) to +10 (wet). Maps of operational agencies like NOAA typically show a range of -4 to +4, but more extreme values are possible. The PDSI has been reasonably successful at quantifying long-term drought.

The U.S. Drought Monitor (Figure 18) combines several input sources including the PDSI and the Standardized Precipitation Index to prepare a weekly map showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4) (Figure 19).

Figure 18. Historical Drought Levels



Source: US Drought Monitor

Figure 19. U.S. Drought Categories and Historically Observed Impacts

Michigan

Category	Historically observed impacts
D0	Grass fires increase
	Lawns are brown; landscape and gardens are watered more frequently
D1	Most crops and vegetation are stressed; farmed Christmas trees are stressed
	Well levels decline
D2	Corn and soybean yields are low
	Mature trees are stressed
	Streamflow is extremely low, potentially too low to irrigate

Source: US Drought Monitor

Previous Occurrences
There have been two instances of drought in Leelanau County. The first event was a Presidential Declared Emergency enacted in 1977 for drought problems in the State and included Leelanau, Lake, Mason, Oceana, and Wexford Counties. The second event occurred on August 1, 2001. No deaths, injuries, or damages are associated with these drought events.

The August 1, 2001 event narrative is as follows:

After a cool beginning, the last half of July 2001 was characterized by warmer than normal and drier than normal weather. Less than an inch of rainfall was recorded in some areas for the month of July. This lack of rain and warm conditions became serious during the first two weeks of August when little if any rain fell and temperatures jumped into the 90s. The stress on the crops was most noted in northern Michigan corn, but also hit hay crops to a lesser extent. As a result of the drought, the U.S.D.A. declared several counties disaster areas and granted farmers in counties where the crop losses were 30% or greater, special low interest loans.

Probability of Future Events and Vulnerability Assessment
Since 2001, Leelanau County has experienced one drought event. This equates to a 4.5% annual chance for a drought event in Leelanau County. Drought can adversely impact residential water sources when well levels decline, agriculture including both crops and livestock, and some tourism and recreational enterprises. Residential water sources are vulnerable during a drought. Many county residents rely on ground water wells for drinking water. Even drought events in category D1 experience water well level decline. Drought events combined with excessive heat can have severe impacts on elderly and low income people.

Leelanau County's economy is highly dependent on agriculture and agri-tourism. Drought may cause the following damages to crops and pastures:

- Agricultural production losses: crop failure and pasture losses
- Decreased water availability: water depletion from soils causes significant decline in crops and livestock productivity
- Pests and diseases: drought, coupled with high temperatures, may expand the distribution and incidence of pests and diseases that affect crops, forage, and livestock.
- Damage to specialty crops: most specialty crops (such as fruits, vegetables, tree nuts, and medicinal herbs) are more vulnerable to drought than field crops and have higher value per unit of land/water.

Interruption in agriculture production can also cause a drop in income, which impacts other economic sectors.

The biggest problem drought presents, however, is the increased threat of wildfire. Western and southern portions of Leelanau County (Cleveland Township, Empire Township, and Glen Arbor Township) are heavily forested and are therefore highly vulnerable to drought-related wildfire threats.

Wildfire

A wildfire is an unplanned, uncontrolled fire in grassland, brushland, or forested areas. Wildfires can occur in any forest or grassland type under dry conditions; however, some forest types are more susceptible to wildland fires. For example, jack and red pine forest stands have a high risk for wildfires, as they dependent on fire to provide all the right conditions for regeneration, while aspen and white pine forest stands have a moderate risk. The primary cause of wildfires is from human activities, specifically burning outdoor debris. Wildfires cause destruction to property and timber resources, and injuries or loss of life to wildlife and persons living or recreating in wildfire prone areas. Long-term effects include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities.

Approximately 55% (20.4 million acres) of Michigan's total land area is forest cover. The vast forests provide Michigan with the largest state-owned forest system in the United States. In addition, Michigan has the fifth largest quantity of timberland acreage, with 19.3 million acres (including hardwoods and softwoods). That vast forest cover is a boon for both industry and recreation, and these areas have been gradually increasing in recent years. However, it also means that many areas of Michigan are vulnerable to wildfires.

Michigan's fire season starts in early spring, when leaves and grasses remain dry from fall and winter and trees are not yet green. Wildfires are often accompanied by drought where dry conditions increase the potential to burn. Often a thunderstorm will roll through and lightning will strike causing sparking of dry leaves and dead wood. High winds can then spread wildfire. Wildfires can become unpredictable in windy conditions or when the wind changes direction suddenly. Cooler nighttime temperatures often help suppress wildfires and the potential for wildfire; however Michigan has had several major fire events.

According to MDNR and U.S. Forest Service records, between 1910 and 1949, over 5.8 million acres of forest were burned, an average of 145,000 acres per year. By comparison, it was reported that between 1950 and 1996, the MDNR and U.S. Forest Service were involved in suppressing over 46,100 wildfires that burned 390,000 acres of forest, which averages only 8,300 acres burned per year. This drastic reduction in the acres of timber burned was largely the result of (1) increased use of specialized equipment to suppress the fires, and (2) intensified efforts toward fire prevention.

However, lightning strikes are not the primary cause of wildfires in Michigan. Recently, only about 4% of all wildfire in Michigan were caused by lightning strikes, and most other causes have been attributed to human activity. Outdoor debris burning is the leading cause of wildfires in Michigan. Most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from wildfires is the destruction of property, timber, wildlife, and injury or loss of life of persons who live in the affected area or who are using recreational facilities in the area.

Location
All of the county's communities and developed areas are vulnerable to wildfires since the community centers and rural residential developments interface with the high risk forest types (e.g. Red Pine, Eastern White Pine, and Jack Pine). Approximately acres or 41% of Leelanau County is forested. Jack Pine forests make up 645 acres of forested land while Red Pine makes up 13,083 acres, and Eastern White Pine makes up 1,062 acres. As shown on the Environmental Features Map in Appendix A, Jack Pine forests are minimal, located primarily in Leland, Leelanau, Glen Arbor, Cleveland, Solon, Bingham, and Elmwood Townships. Red Pine and Eastern White Pine forests are located countywide.

Extent and Previous Occurrences
Extent can be measured by the number of acres burned and the cost of property damage. Between 1996 and 2017 there were no wildfires reported outside of MDNR lands in Leelanau County. Between 1981 and 2018 there were 60 reported fires on lands under MDNR jurisdiction. This resulted in 267.6 acres burned and 7 acres burned per year. No property damages were recorded. Public lands, including MDNR lands, are located throughout the county, especially in Empire Township, Glen Arbor Township, and Cleveland Township.

Probability of Future Events and Vulnerability Assessment
There is a 100% chance there will be a wildfire on MDNR lands, and a small chance there will be a wildfire on lands outside of MDNR jurisdiction. Forest types (Red Pine, Eastern White Pine, and Jack Pine) within Leelanau County are susceptible to wildfires. Western and southern portions of Leelanau County (Cleveland Township, Centerville Township, Empire Township, and Glen Arbor Township) are heavily forested and are therefore highly vulnerable to wildfire threats.

Additional factors that increase fire risk include dead or dying Ash trees as a result of disease/invasive species, invasive species itself, lightning strikes, and human factors such as the number of persons residing, camping, or traveling through the County. Historically, Michigan's landscape has been shaped by wildfire; however, over the last several decades, the

current landscape has transformed from wildland to residential development. With the increase in residential development in and around rural areas prone to wildfires, there is an increase in the potential for loss of life and property damage. Local fire departments have mutual aid agreements in order to provide additional coverage for rural, sparsely populated, or difficult to reach areas. Residential development in rural Leelanau County is often isolated from town centers and emergency services. Many of these areas interface with public lands and local emergency services coordinate fire services with State and Federal fire protection agencies.

Shoreline Hazards

Shoreline hazards for Leelanau County include coastal flooding, coastal recession, dangerous currents, and seiche.

Coastal recession (subsidence) is the wearing away of land, such as loss of riverbank, beach, shoreline, or dune material. It is measured as the rate of change in the position or displacement of a riverbank or shoreline over a period of time. Short-term erosion typically results from periodic natural events, such as flooding, hurricanes, storm surge, and windstorms, but may be intensified by human activities. Long-term erosion is a result of multi-year impacts such as repetitive flooding, wave action, sea level rise, sediment loss, subsidence, and climate change. Death and injury are not typically associated with erosion; however, it can destroy buildings and infrastructure. Waters of the Great Lakes may cause shoreline hazards to occur making the entire northwest Michigan coastline is susceptible to shoreline hazards. As indicated in Figure 20, large portions of the Lake Michigan shoreline throughout west Michigan are identified as “High Risk Erosion Areas in 2019.”

Coastal (shoreline) flooding results when Great Lakes water levels rise and push inland, or when rainfall or snowmelt accumulates along the shoreline and is not able to drain properly. Shoreline flooding may also be caused during storms and wind events with high-energy waves.

The entire northwest Michigan coastline is susceptible to shoreline hazards.

Figure 20. Great Lakes Shorelines with High Risk Erosion Areas, 2019

Location
To reference the 2019 *Northwest Lower Michigan Coastal Resilience Atlas*, “Climate scientists predict that northwest Lower Michigan can expect more frequent storms of increasing severity in the decades ahead. The total amount of rainfall per year in also likely to increase. The potential for substantially larger rain events and severe storms raises concerns of harm to human health and damage to buildings and infrastructure, especially for areas along the Lake Michigan coastline.”

Jurisdictions located on the Lake Michigan and Grand Traverse Bay coast are impacted by shoreline hazards: City of Traverse City, Village of Empire, Village or Northport, Village of Suttons Bay, and the following coastal townships: Elmwood, Bingham, Suttons Bay, Leelanau, Leland, Centerville, Cleveland, Glen Arbor, and Empire. The Land Information Access Association documented potential shoreline hazards for these communities in the *Northwest Lower Michigan Coastal Resilience Atlas*. Specific areas of shoreline hazards were also identified during public input session for this plan. These are marked as a “shoreline erosion” type of hazard area on the Hazard Area Map in Appendix A.

In developing the *Northwest Lower Michigan Coastal Resilience Atlas,* scenario planning was used to determine the potential impact of three differing levels of storms combined with high waters. The three scenarios are described as follows:

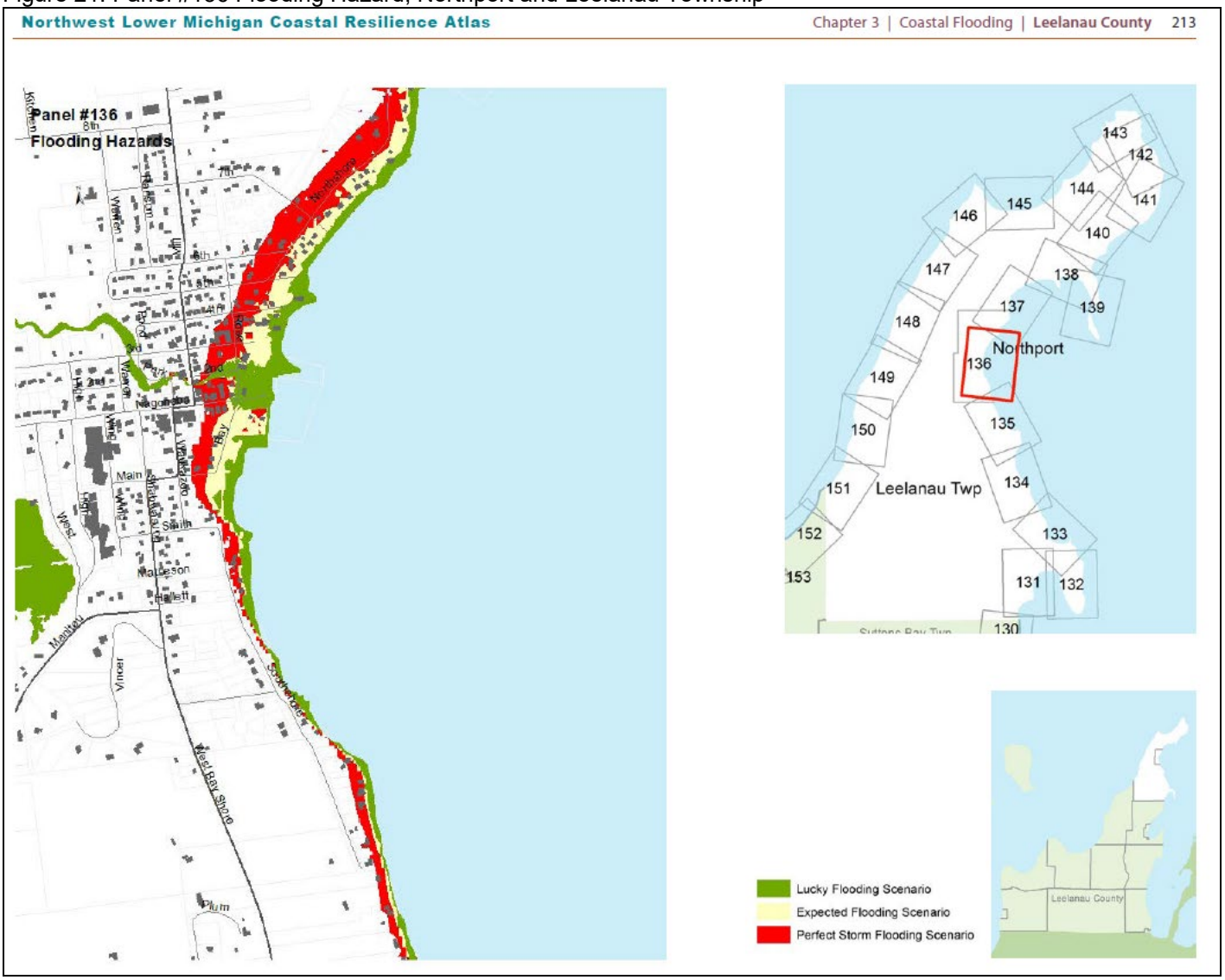
The first scenario, **“Lucky” Future:** Under the Lucky Climate Future, Great Lakes water levels will continue to stay relatively low. Although there will be wave and wind action, major storm events and wave impacts will not encroach on properties landward of current beaches. A Lucky Future projection, indicating the land areas that would be affected by high-energy waves along the shorefront and/or adjacent riverine flooding under these conditions, is shown in green on the maps.

“Expected” Future: Under the Expected Climate Future, Great Lakes water levels will continue to fluctuate according to long-term decadal patterns, including recent extreme storm events incorporated into the ongoing Great Lakes Coast Flood Study being conducted by the Federal Emergency Management Agency (FEMA). Given those ongoing fluctuations, this Climate Future accounts for periods when Great Lakes still-water elevations are closer to the long-term average. In addition, this Climate Future anticipates the so-called “100-year storm event” (or 1% storm) becoming more like a 20- or 50-year storm event (i.e., an expected storm within the normal community planning time horizon) because of increased storminess. The Expected Future projection is shown in yellow on the maps.

“Perfect Storm” Future: Under the Perfect Storm Climate Future, Great Lakes water levels will continue to fluctuate according to decadal patterns, consistent with assumptions made for the Expected Future. However, for this Perfect Storm Climate Future, the estimated still-water elevation is set higher than the long-term average and closer to the long-term high (583 feet). In addition, this Climate Future anticipates the occurrence of a so-called “500-year storm event” (or 0.2% storm) occurring within the planning time horizon while lake levels are high. The Perfect Storm Future projection is shown in red on the maps.

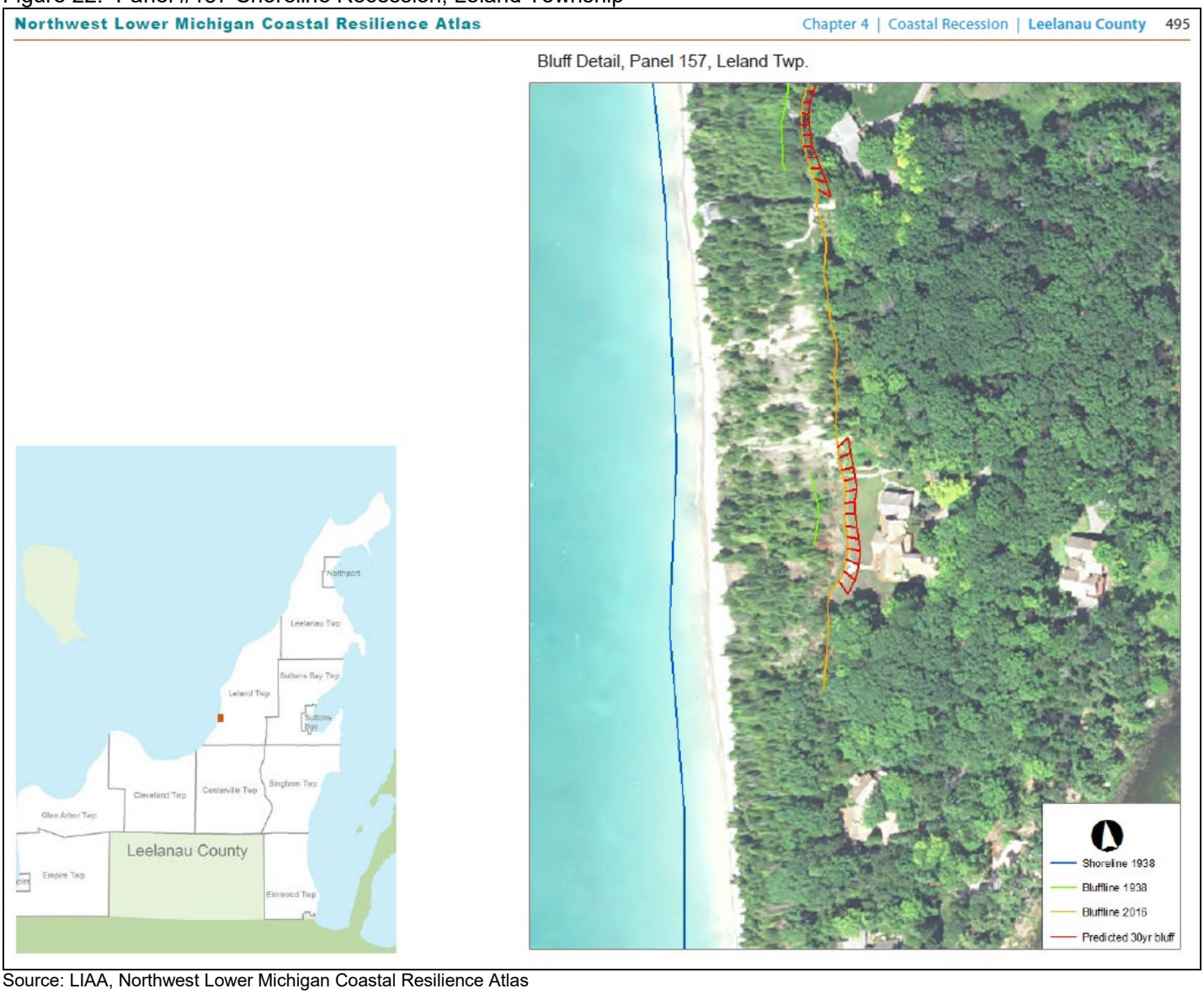
Localized flooding for each scenario is very pronounced in the Village of Northport and Leelanau Township shown in Figure 21. Areas shaded in green reach inland to the edge of known structures, covering structures in some places. The yellow shaded area reaches farther inland covering the first row of structures, and the red shaded area reaches the farthest inland covering many structures. This is one community example; the full report has an analysis for each panel.

Figure 21. Panel #136 Flooding Hazard, Northport and Leelanau Township



Coastal recession, or erosion, to Lake Michigan communities is a constant, but very small wearing away of the shoreline. The Great Lakes are estimated to lose one foot of shoreline per year to normal wave and wind activity. However, storms and increased wave activity have caused increased coastal recession to varying degrees in Leelanau County's coastal communities. Chapter 4 of the *Northwest Lower Michigan Coastal Resilience Atlas* describes bluffline recession since its recorded shoreline in 1938. The blue line indicates the shoreline in 1938, the green line indicates the bluffline in 1938, the yellow line is the bluffline in 2016, and the red line is the predicted 30 year bluffline. The varying lines are shown in Figure 22 depicting the recession of the bluffline in Acme Township near the LochenHeath Golf Club.

Figure 22. Panel #157 Shoreline Recession, Leland Township



Source: LIAA, Northwest Lower Michigan Coastal Resilience Atlas

The communities of Bingham Township, Glen Arbor Township, Leelanau Township, Leland Township, Suttons Bay Township, and the Village of Empire contain "High Risk Erosion Areas" (HREAs) as designated and regulated by the State of Michigan's Department of EGLE. HREAs are shorelines of the Great Lakes where the land is receding at a rate of one foot or more per year for a minimum of 15 years. Recession rates change over time as water levels fluctuate and coastal conditions change. Along these shorelines, new structures are required to meet setbacks for their protection from a changing shoreline. When structures are not in danger, the shoreline does not need to be altered to protect the structure.

A permit is required for construction, movement, or enlargement of a structure on any portion of a designated HREA parcel regardless of how far the project is from the lakeshore. Common activities requiring a permit include construction of a house, garage, or addition, substantial reconstruction of an existing home, the installation of a septic system, covered porches, or a commercial building. HREAs are regulated by the Administrative Rules of Part 323, Shorelands Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Currently EGLE administers Part 323 for all HREAs in the county.

The communities of Centerville Township, Cleveland Township, Empire Township, Village of Empire, Glen Arbor Township, Leelanau Township and Leland Township contain State-designated "Critical Dune Areas" (CDAs), are a combination of coastal barrier dunes, land that has dune-like features, and unique plant communities along a Great Lakes shoreline. Regulatory authority goes to the water's edge. The CDAs include public lands and private properties where developmental, silvicultural, and recreational activities are regulated and a permit is required under Part 353, Sand Dunes

Protection and Management, of the Natural Resources and Environmental Protection Act for activities that significantly alter the CDA, such as the construction of a house or garage, building a road or driveway, installing a septic system, installing retaining walls, and sand removal. The law balances the benefits of protecting, preserving, restoring and enhancing the diversity, quality, functions, and value of the critical dunes with the benefits of economic development, multiple uses, and public access. Currently EGLE administers Part 353 for all CDAs in the county.

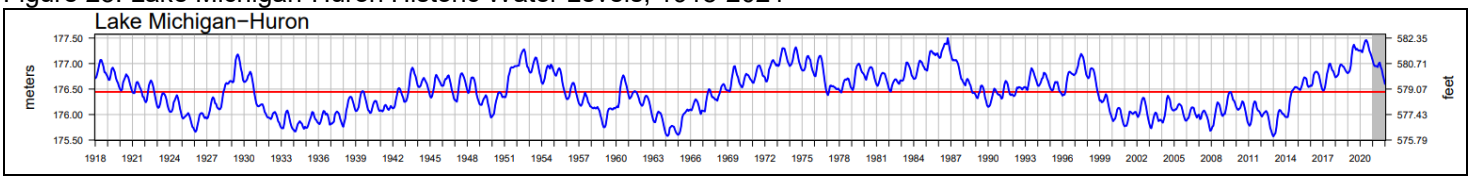
The HREAs and CDAs in Leelanau County are shown on the Environmental Features Map are included in Appendix A.

Extent

Shoreline recession can be measured by feet of bluffline retreat and property damages. Bluffline retreat distances vary across the county, and there are no reported damages from bluffline recession. Shoreline flooding can be measured by flood water levels, inches of rainfall, lake water levels (shown in Figure 23), and damages. The lakeshore flooding events in 2019 and 2020 caused $179,000 in property damages.

In recent years, the swings in water levels have been unprecedented. In January 2013, Lake Michigan-Huron set an all-time record low of 576.02 feet, and seven years later in July of 2020 Lake Michigan-Huron reached a monthly record high of 582.22, only second to the October 1986 monthly record high of 582.35.

Figure 23. Lake Michigan-Huron Historic Water Levels, 1918-2021



LAKES MICHIGAN-HURON

2021	*580.94*	*580.68*	*580.54*	*580.54*	*580.54*	*580.48*	*580.71*	*580.77*	*580.48*	*580.41*	*579.95*	*579.69*	*580.48*
Mean	**578.48**	**578.44**	**578.48**	**578.77**	**579.07**	**579.30**	**579.40**	**579.33**	**579.17**	**578.94**	**578.77**	**578.61**	**578.90**
Max	581.56	581.53	581.43	581.69	581.96	582.19	582.22	582.09	581.96	582.35	581.96	581.56	
	2020	2020	2020	2020	2020	2020	2020	2020	1986	1986	1986	1986	
Min	576.02	576.08	576.05	576.15	576.57	576.64	576.71	576.67	576.64	576.44	576.28	576.15	
	2013	1964	1964	1964	1964	1964	1964	1964	1964	1964	1964	2012	

Source: US Army Corps of Engineers

Previous Occurrences

The Great Lakes experienced record high lake levels in 1985-86, again in 1997-98, and again in 2019-20. Many cases of erosion are present and high lake levels causing rivers and tributaries to back up have caused infrastructure damage and failures throughout Leelanau County and many other areas in Michigan. More specifically, three incidents have been reported with NOAA for Leelanau County. The first occurred on October 16, 2019, the second occurred on October 21, 2019, and the third occurred on April 13, 2020.

The narrative of the event on October 16, 2019 is as follows:

Northwest to north winds produced high waves and elevated water levels along the northwest lower Michigan coastline. With Great Lakes water levels at near-record levels, significant coastal flooding and beach erosion resulted. The parking lot of the Grand Traverse Yacht Club was flooded.

The second event occurred on October 21, 2019. *Strong northerly to easterly winds resulted in another round of substantial coastal flooding and beach erosion, this time on both Lake Michigan and Lake Huron, for the 21st into the 22nd. In Northport on the 21st, a dock was damaged and a boat house was flooded. Water levels rose over the docks at Northport Marina. On the 22nd in Empire, a part of the break wall at Empire Beach was destroyed. In Glen Haven, restoration efforts from flooding earlier in the month were eliminated, and shoreline fences were destroyed at Glen Haven Beach.*

Probability of Future Events and Vulnerability Assessment

Michigan lakeshore flood events began being recorded in 2014. Over the nine years, three events have occurred. This indicates there is a 33% annual chance of shoreline flooding and an equal chance erosion will cause shoreline damages. The shoreline hazards of 2019 and 2020 occurred under unique circumstances when the Great Lakes water levels were above average. Based on past water level measurements, similar levels are not likely to occur for some time. On the contrary, the Great Lakes may experience low water levels with the ebb and flow of the lakes.

Shoreline or soil erosion hazards involve the loss of property or necessitate the relocation of homes as sand or soil is removed by flowing water (lake, river, etc.) and carried away over time. The foundation of a structure, or underground utility pipes in the area, may become fully exposed and vulnerable to weather, extreme temperatures, water damage, or other sources of risk. Shoreline banks that support roadways may erode and cause the road surface to crack, become unstable, or more prone to deposits of sand, snow, water, and ice. This hazard is especially relevant to those municipalities that contain residential and commercial development along Lake Michigan and the Grand Traverse Bay (City of Traverse City, Village of Empire, Village or Northport, Village of Suttons Bay, and the following coastal townships: Elmwood, Bingham, Suttons Bay, Leelanau, Leland, Centerville, Cleveland, Glen Arbor, and Empire) that experience seasonal shifts in water levels and possible ice erosion hazards.

As lake water levels fluctuate and increased storminess occurs, shoreline recession and flooding will continue. In 2021 the levels of Lake Michigan-Huron began to decline, however, as historic data shows us, the water will begin to rise again. Those communities that have already faced shoreline hazards are likely to experience issues in the future. Changes in land use practices and improvements to the shoreline such as natural vegetation plantings or shoreline armoring may reinforce the shoreline for a period of time, but is likely not a permanent solution. The following is an excerpt from the *Leelanau County Plan, Amended 2019.*

> *Seemingly endless shorelines and monumental dunal formations epitomize the grandeur of the area. While these resources serve as critical components of the County's tourism and recreation industry, they are particularly vulnerable to wind and wave action, as well as to any land use and development activities which disturb the stability of the dunes. The clearing of vegetation along shorelines and dunes seriously increases their susceptibility to erosion, shifting, and demise. Disturbance of their natural character by land use activities heightens their vulnerability to winds and waves, and other climatic forces. Many of the County's shoreline areas and dunal formations are considered "high risk erosion areas." The significance of these areas is highlighted by their inclusion for protection under the Michigan Natural Resources Act 451. This Act serves to protect designated "critical dune areas", including Sleeping Bear Dunes and Empire Bluffs as well as less prominent dune areas.*
>
> *The Lake Michigan shoreline and dunal formations harbor yet another sensitive environmental resource - threatened and endangered plant and animal species. Inventories by the Michigan Department of Natural Resources have identified numerous unique plant and animal species in the County which rely largely upon shoreline and dune areas for their survival. Other threatened species which rely upon a more inland environment have also been identified. The fact that these plant and animal species are already considered unique due to their threatened survival emphasizes the need to prevent disturbances in the ecosystem in which they thrive.*
>
> *Shorelines of inland lakes are also sensitive natural resources. The calmer waters and areas of interface between the land and water are particularly important habitats for wildlife and plant life. Understandably, these areas are also actively sought for development and recreational use. The resulting threat to these environments through soil erosion and sedimentation, disturbance of the natural shoreline and vegetation, and leachate from faulty septic systems is a concern today and will become more significant as the County's population grows.*

Dangerous Currents

Dangerous currents and breaking waves are common in the Great Lakes region. Rip currents and other currents found near piers are extremely dangerous for swimmers and can lead to drownings. Currents in the Great Lakes can form from any combination of wind, waves, bottom formation, beach slope, water temperature, man-made structures, and natural outlets. In the Great Lakes, swimmers are most likely to encounter one of five common currents: rip, longshore, structural, outlet, and channel.

During rip currents, the water "piles up" between a sandbar and the beach. It has to find a way back out to sea. After the pressure builds up, the water creates a pathway and gushes from the shore back out to open water. That's a rip current: a narrow but powerful stream of water and sand moving (ripping) swiftly away from shore. Rip currents vary in size and speed and can be found on many beaches every day. They typically extend from the shoreline through the surf zone, and past the line of breaking waves. Typically, they form at breaks in sandbars, and also near structures, such as jetties and piers, as well as cliffs that jut into the water.

Rip currents carry swimmers into deeper water, where they may not be able to get their footing. These currents rarely extend far out, and will not pull a swimmer underwater. Rip currents vary in size from very narrow to more than 50 yards wide. Speeds can also vary. The average speed is 1-2 feet per second, but they have been measured as fast as 8 feet per second.

Longshore currents move parallel to or the "long" way along the shoreline. These currents will exert a force to move along shore, making it difficult to remain in front of a spot on the beach. They often happen between the first and second sandbars near the shore. Longshore currents become more dangerous when they combine with rip currents or structural currents since they can move a swimmer swiftly down a beach and into the path of another current or into a structure (pier or breakwall), making it more difficult to swim to shore.

Structural currents - the currents found alongside or as a result of structures like piers and breakwalls - are usually always present. Structural currents are dangerous on their own, but when paired with others like longshore or rip currents, the combination can create a washing machine effect, moving the swimmer from one dangerous current area to another with no clear path to safety.

Outlet currents can be found where rivers and streams empty into the Great Lakes. The flow of water from the river or stream can move quickly. As it enters the open water of a lake, it may take awhile for that current to dissipate. Pair that with currents that are present in the lake and the situation can become dangerous.

Channel currents are like a river running parallel to shore. With a channel current, typically there is an island or structure such as a large group of rocks not far from shore. A channel current forms when the flow of water speeds up as it goes between the island and shore, like a bottleneck. This is made worse by the presence of a submerged or partially submerged sandbar connecting the beach to the island, which allows pressure to build behind the water and waves until it breaks through. When the wind speed increases, the waves also increase in intensity, and this causes the current to become stronger and faster.

According to the Great Lakes Current Incident Database, between 2002 and 2020, there have been 75 deaths and 274 persons rescued from dangerous current incidents along the Lake Michigan coastline of Michigan's Lower Peninsula.

It is important to note that there are no "rip tides" or "undertows" in the Great Lakes. Since there are no tides in the Great Lakes, and rip currents don't pull a person down under the water (it will carry them out to the open water, away from shore), "rip tides" or "undertows" are inaccurate coastal hazard terms.

Location
All Lake Michigan coastal areas in Leelanau County are at risk to the occurrence and impacts from dangerous currents.

Dangerous current-related incidents in the Great Lakes most often occur when:

- Winds are blowing towards the shore
- Wave heights reach 3 to 6 feet
- A cold weather front is passing through

Location
Rip currents are a coastal event that is not confined to geographic boundaries and may occur anywhere in Lake Michigan waters. All coastal areas are at risk to the occurrence and impacts from rip currents.

Extent
The National Weather Service provides a Surf Zone Forecast to measure the risk level associated with rip current hazards. Surf Zone Forecasts contain three levels of Rip Current Outlooks:

- Low Risk: The risk for rip currents is low, however, life threatening rip currents often occur in the vicinity of groins, jetties, reefs, and piers.
- Moderate Risk: Life threatening rip currents are possible in the surf zone.
- High Risk: Life threatening rip currents are likely in the surf zone.

Rip currents can be measured by damages-caused including deaths and injuries. There has been one significant rip current event in Leelanau County, and one death was reported.

Previous Occurrences
Leelanau County has had one reported fatality from a rip current event (Table 37). The event occurred on August 30, 2012. The event narrative is as follows:

Southwest winds of 20 to 30 mph producing significant wave action and strong currents along the Lake Michigan coast. Three individuals were caught in rip currents near Van's Beach in Leland. One was rescued via kayak; a second managed to escape and swim back to shore. Unfortunately, the third, a teenaged male from Lake Leelanau, went under and disappeared. His body was found by searchers the next day, in about six feet of water.

Table 37. Rip Current Events

Date	Fatalities	Rescues	Beach Name	Location	Type Of Current	Wave Direction	Wave Height (ft)
8/30/2012	1	2	Van's Beach	Leland Township	Classic Rip	S	5 TO 6

Source: Great Lakes Current Incident Database https://www.michiganseagrant.org/dcd/dcdsearch.php

It is likely that more rip current events have occurred and gone reported. There are instances of fatalities from rip currents in nearby coastal counties including Benzie, Emmet, and Manistee Counties.

Probability of Future Events and Vulnerability Assessment
One dangerous current event has occurred since 2002, equating to a 4.7% chance of a dangerous current event happening in a future year. Dangerous current events are likely to occur more frequently, but go unreported as injuries and deaths do not occur. Lake Michigan currents are dangerous to all swimmers, especially those who are unprepared to be swept up in the current. Many Lake Michigan beaches do not have a lifeguard on duty who may identify potential hazardous swimming conditions. Swimmers who are caught unaware may panic when caught up in the fast-moving water, tire as they try to swim against the current, and drown. All communities in Leelanau County, with the exception of Kasson and Solon Townships, have public beach access to Lake Michigan or West Grand Traverse Bay.

Seiche

According to the National Weather Service, a seiche is a standing-wave oscillation in any enclosed lake that continues after a forcing mechanism has ceased and results in shoreline flooding and/or damage. In the Great Lakes and large inland lakes, large pressure differences, high winds, or fast-moving squall lines may act as the forcing mechanism. In addition, earthquakes or debris flows can initiate a seiche. When the forcing mechanism ends, the water sloshes back and forth from one end of the lake to the other, causing water level fluctuations of up to several feet before damping out.

Seiches are usually limited to partially or fully enclosed basins, such as Lake Erie. Lake Erie is known for seiches, especially when strong winds blow from southwest to northeast. In 1844, a 22-foot seiche breached a 14-foot-high sea wall killing 78 people and damming the ice to the extent that Niagara Falls temporarily stopped flowing. As recently as 2008, strong winds created waves 12 to 16 feet high in Lake Erie, leading to flooding near Buffalo, New York.

In some of the Great Lakes and other large bodies of water, the time period between the "high" and "low" of a seiche can be as much as four to seven hours. This is very similar to the time period between a high and low tide in the oceans, and is often mistaken as a tide.

According to the NOAA-NCEI Storm Events Database, there have been 15 seiche events in Michigan since 1998. There are no deaths, no injuries, and $31,000 in property damages due to seiche events.

Location
Seiches are a coastal event that is not confined to geographic boundaries and may occur anywhere in Lake Michigan waters or on large inland lakes. All coastal areas are at risk to the occurrence and impacts from a seiche.

Extent
Seiche events can be measured by damages-caused including deaths, injuries, and property damages. There has been one significant seiche event in Leelanau County, and no deaths or injuries were reported.

Previous Occurrences
Leelanau County has had one seiche event. The event occurred on May 9, 2019, affecting Leland Township, and caused $5,000 in property damages. The NOAA NCEI Storm Events Database narrative for the event is as follows:

The sudden relaxation of a gusty east wind, and quick transition to a northwest wind, resulted in a seiche on Lake Michigan. With very high water levels already in place on all of the Great Lakes, localized flooding developed. Water entered some of the historic fishing shanties in the Fishtown section of Leland. Sandbags and other methods were deployed to attempt to keep the water out.

Probability of Future Events and Vulnerability Assessment
One seiche event has occurred in Leelanau County in the past 25 years, indicating that there is a 4% of a seiche event happening in a future year. Seiche events are likely to occur more frequently, but go unreported as injuries, deaths, or damages do not occur. As noted in the May 9, 2019 event and others, persons and property along the lake shore are also vulnerable to high waves caused by a seiche. Seiche events are also dangerous to all swimmers, especially those who are unprepared to be swept up in the current. Many Lake Michigan beaches do not have a lifeguard on duty who may identify potential hazardous swimming conditions. All communities in Leelanau County, with the exception of Kasson and Solon Townships, have public beach access to Lake Michigan or West Grand Traverse Bay.

Public Health Emergency (Infectious Disease)

Public health emergencies occur when there is a widespread and/or severe epidemic, contamination incident, bioterrorist attacks, or other situation that negatively impacts the health and welfare of the public. These emergencies include disease epidemics, large-scale food or water contamination incidents, extended periods without adequate water and sewer services, harmful exposure to chemical, radiological or biological agents, and large-scale infestations of disease-carrying insects or rodents. A common characteristic of public health emergencies is that they impact or have the potential to impact a large number of people either statewide, regionally, or locally in scope and magnitude. These health emergencies can occur as primary events or as secondary events from another hazard or emergency (e.g. flood, tornado, or hazardous material incident).

Location
Public Health Emergency can be a worldwide, national, state or regional event that is not confined to geographic boundaries and range in severity across the affected areas. All of Leelanau County is at risk to the occurrence and impacts from an infectious disease. Depending on the type of disease, different populations are more susceptible.

Extent
The extent of a public health emergency can be determined by the number of cases and deaths, and the amount of money spent to prepare for and respond to public health threats. In Leelanau County, the Benzie-Leelanau Health Department works with local, state, and federal agencies to prepare for and respond to public health threats. It developed a comprehensive emergency preparedness program capable of responding to a variety of emergency situations with funds from the Centers for Disease Control. The State of Michigan reports, as of October 4, 2022, there are 4,173 cumulative cases of COVID-19 and 63 deaths in Leelanau County. Those 80 years and older have the most deaths of any age range at 31 deaths.

Previous Occurrences
Throughout the years, there have been many pandemics. For example, there was an outbreak of severe acute respiratory syndrome (SARS) in 2003. This virus was a new coronavirus that resulted in over 8,000 illnesses worldwide. Of these, 774 died. Since 2012, Middle East respiratory syndrome (MERS), a coronavirus, has been reported in 27 countries where there have been approximately 2,494 people infected and 858 deaths. In 2017, the World Health Organization (WHO) put SARS and MERS on its priority pathogen list to spur further research into coronaviruses. More recently in 2020, a Presidential and Governor Emergency was declared for COVID-19 Pandemic in Michigan.

Probability of Future Events and Vulnerability Assessment
Naturally occurring pandemics may result in widespread precautions around the world. The Benzie-Leelanau Health Department created a pandemic plan that serves as a template for responding to a large-scale outbreak of influenza and other highly infectious respiratory diseases. That plan is being tested currently since COVID-19 appeared in January 2020. The response is ongoing to this pandemic. The elderly, immune-compromised, and low income populations are most vulnerable to public health emergencies.

Invasive Species

The National Invasive Species Council defines an invasive species as, "A species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health." The Council was formed under Presidential Executive Orders 13112 and 13751 to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established throughout the United States. NOAA's National Ocean Service identifies invasive species as "capable of causing extinctions of native plants and animals, reducing biodiversity, competing with native organisms for limited resources, and altering habitats." There are a wide variety of species considered invasive. Known and monitored species include:

- Mammals
- Birds
- Insects
- Fish
- Crustaceans
- Mollusks
- Worms
- Plants
- Diseases

Invasive species harmful to Michigan and Leelanau County may be either terrestrial invasive species (TIS) or aquatic invasive species (AIS). Terrestrial invasive include non-native, land-based plants, insects, animals and diseases that harm Michigan's environment, economy, and human health. Aquatic invasive include non-native, water-dwelling plants, animals, and other organisms that have evolved to live primarily in water (aquatic habitats) rather than on land. Aquatic habitats are habitats that are covered with water all or part of every year. Michigan State Departments cooperated to prepare the Terrestrial Invasive Species State Management Plan and the 2013 Aquatic Invasive Species State Management Plan Update: *Prevention, Detection, and Management in Michigan Waters.* Each plan outlines a statewide strategy to reduce the environmental and economic damages caused by either TIS or AIS.

Non-native terrestrial and aquatic species are introduced to Michigan and the Great Lakes both intentionally and unintentionally. Aquatic invasive species are the result of unwanted fish and aquatic plants released from home aquariums, travelled across the ocean in ballast water carried by freighters, or entered from the ocean through human-built channels such as the Welland Canal.[5] There are 32 AIS specifically listed in the State Management Plan. The State TIS Management Plan lists fourteen species including insects, mollusks, plants, mammals, a shrub, and a bird.

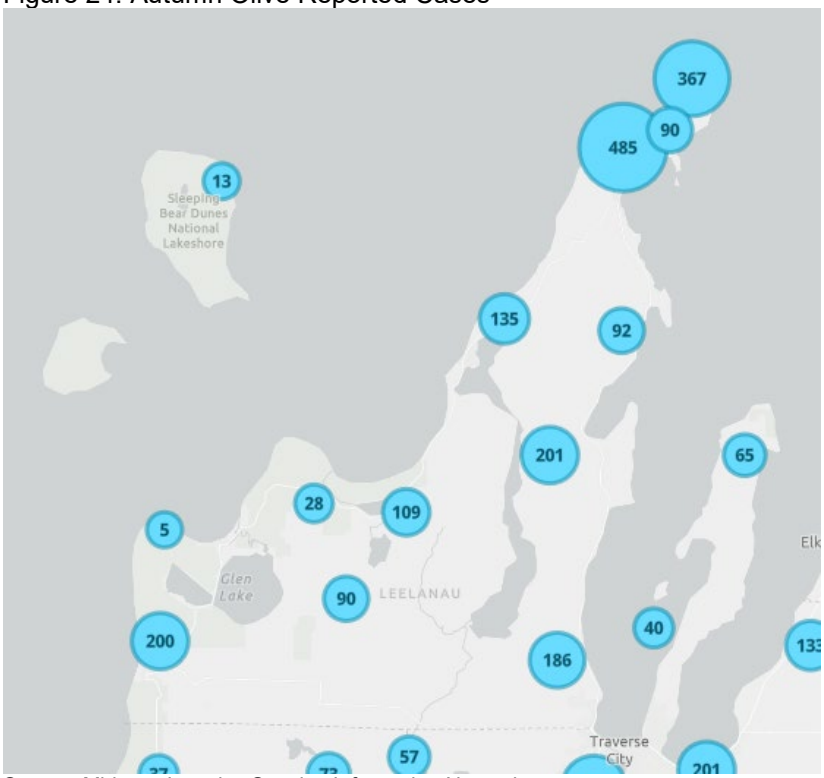
The Midwest Invasive Species Network (MISIN) is a regional effort to develop and provide early detection and response resources for invasive species. Among many tools and resources, the website (misin.msu.edu) provides a catalog of species information and a report of occurrences submitted within each state. Animals, plants, and diseases are included in the catalog. The top five reported species in Michigan are: phragmites (invasive) with 63,018, garlic mustard with 18,368, autumn olive with 16,042, spotted knapweed with 15,436, and brown marmorated stink bug with 13,351.

Location

Invasive species threaten those sensitive ecosystems and may be present in all Leelanau County forest, wetland, farmland, grassland, aquatic, and urban environments. "A Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan" (Campbell, Higman, Slaughter, Schools) identifies the Lake Michigan coastline as particularly vulnerable. "Lake-moderated climates along the Lake Michigan shoreline, Saginaw Bay, the Thumb, Lake St. Clair, and western Lake Erie are much milder than those in the state's interior… These areas have the potential to harbor species typically found far south of Michigan." TIS and AIS designation generally applies, however, to several upland species that appear to be spreading to wetland and aquatic areas. Regular monitoring and reporting introductions detected is the only way to know where an invasive species has infested. The MISIN Species Observations Data Viewer (online) shares reported detections by species name (common and scientific) and family type. Figure 24 identifies reported Autumn Olive cases throughout the county. Reported cases heavily focused in shoreline areas as well as near lakes and rivers. Areas in Leland Township, Leelanau Township, and Village of Northport have the most reported cases.

[5] The Welland Canal is a ship canal in Ontario, Canada, connecting Lake Ontario and Lake Erie.

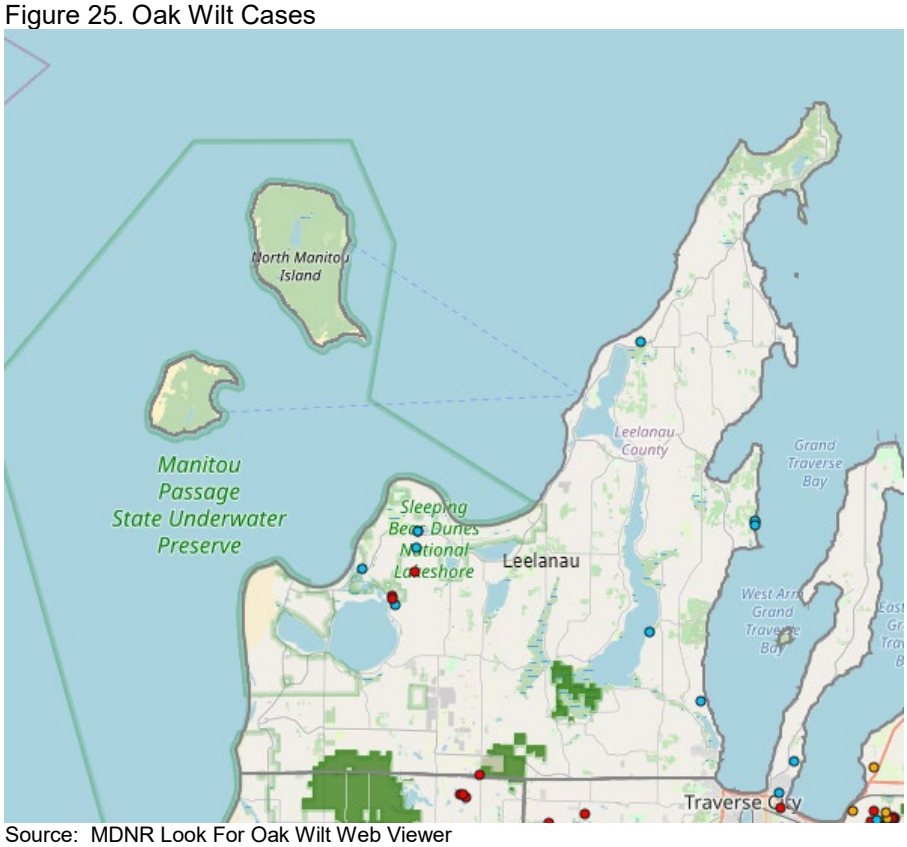
Figure 24. Autumn Olive Reported Cases



Source: Midwest Invasive Species Information Network

Figure 25 presents the MDNR interactive mapping resource Look for Oak Wilt, which allows users to submit and Oak Wilt Report throughout Michigan. A number of Oak Wilt cases have been reported in Leelanau County. These include trees confirmed positive for the disease, trees that have been treated, and reported cases. The reports of Oak Wilt disease are largely found in heavily forested areas and public lands of the west-central, north, and east areas of the county.

Figure 25. Oak Wilt Cases



Source: MDNR Look For Oak Wilt Web Viewer

Extent
Invasive species impact can be measured by its damaging effects. TIS cause billions of dollars in damage annually, are extremely costly to control, and often have irreversible ecological effects. Native habitats, agriculture lands and livestock, and the outdoor recreation economy are threatened or damaged by invasive species. *Michigan's Terrestrial Invasive Species State Management Plan* lists these state impacts:

- The State of Michigan estimates 42% of threatened or endangered species are considered at risk due to non-native species.
- Visitors spent over $22 billion dollars in Michigan in 2014, supporting nearly 327,000 jobs (Tourism Economics 2014). Invasive species impact the use and beauty of Michigan's shorelines, trails and parks, which may result in a reduction in visitor spending and citizen enjoyment
- Michigan's Forest Products Industry supports 96,000 jobs and contributes more than $20 billion to the state's economy each year (Michigan DNR 2015). Invasive forest pests including emerald ash borer, oak wilt and beech bark disease kill trees and significantly impact the value of urban properties, forests and timber resources. The estimated cost of treating or removing dead ash within developed land in Michigan's communities due to emerald ash borer was $230 million in 2009[6].

The Grand Traverse Conservation District serves the four counties of Benzie, Manistee, Leelanau and Grand Traverse, and is a partner and fiduciary agent of the Northwest Michigan Invasive Species Network (NWISN). The typical annual budget is around $225,000 for invasive species management efforts in all four counties.

Previous Occurrences
The Department of Environment, Great Lakes, and Energy (EGLE) oversees invasive species programs for the State. The State has produced prohibited and restricted species lists, watch lists, and state management plans for terrestrial and aquatic species. Many of the species listed in this plan are also listed as a prohibited or restricted species: it is unlawful to possess, introduce, import, sell, or offer that species for sale as a live organism, except under certain circumstances. A full list of prohibited and restricted species can be found at Michigan.gov/invasives.

The Northwest Michigan Invasive Species Network (NMISN) works directly with over 60 partners in Benzie, Grand Traverse, Leelanau, and Manistee Counties to manage populations of terrestrial invasive species that threaten northwest Michigan's high-quality natural areas, such as around Lake Michigan coastal dunes and waterways & riparian areas. Figure 26 describes NWISN's top 12 invasive terrestrial species in northwest Michigan that are targeted for management efforts. These species are already established in the region and are prioritized based on their habitat impact and management feasibility. Furthermore, NWISN has indicated that the top priority species particular to Leelanau County include: invasive knotweeds, invasive phragmites, baby's breath, coltsfoot, and hemlock wooly adelgid (HWA – described on the next page.) Invasive knotweeds have the potential for destruction of infrastructure, an ability to spread easily, and have dense growth patterns. Invasive phragmites negatively impacts habitat quality and can also restrict beach use and lower property values. Baby's breath grows on the sand dunes and beaches along Lake Michigan, which can limit recreational use of the beaches and can also threaten some federally threatened species, including pitcher's thistles. Additionally, coltsfoot is a species that has been found in Leelanau County and grows in the same areas as the federally endangered Michigan monkey flower, which is a species that is endemic to Michigan.

[6] Kovacs, K.F., R.G. Haight, D.G. McCullough, R.J. Mercader, N.W. Siegert and A.M. Liebhold. 2010. Cost of potential emerald ash borer damage in U.S. communities, 2009−2019. Ecological Economics 69: 569-578.

Figure 26. NWISN'S Top 12 Invasive Species

One emerging invasive species of concern, known as the hemlock woolly adelgid (HWA) (Adelges tsugae), has been detected on eastern hemlock trees (*Tsuga canadensis*). Often found along ravines, hillsides, and stream banks, eastern hemlock offer habitat for wildlife and provide shade for streams, effectively lowering stream temperatures and increasing oxygen for fish and other aquatic species. Hemlocks provide aesthetic value and are loved by homeowners. It is estimated that Michigan is home to 170 million eastern hemlock trees.

Areas near the Lake Michigan shoreline are the most probable for new infestations, as the adelgids tend to favor the temperatures and conditions found near the lake more than those inland. HWA is spreading north, up the coast of Lake Michigan, and most recently, infestations have been found in southerly adjoining Benzie County.

In 2018, NMISN and regional partners established a map that narrowed down areas that were expected to be denser with hemlock – following the current trajectory of HWA movement in Michigan. Winter surveys took place to minimize any potential spread of the invasive and because it is easier to locate the woolly mass of HWA ovisacs underneath hemlock needles. NMISN's focus was on easier-to-access locations such as public land and conservation easements. The following winter, the focus shifted to private land surveys. Landowners meeting the following requirements are encouraged to complete a landowner survey from NMISN (on their website):

- Property is in Benzie, Grand Traverse, Leelanau or Manistee County (required)
- Located within 10 miles of the Lake Michigan shoreline (required)
- A hemlock tree you planted was purchased from an online retailer

In 2021, a single tree infested with HWA was found at a campsite at the Sleeping Bear Dunes National Lakeshore in Lake Township, Benzie County. That hemlock and all hemlocks within an 800 foot buffer were preventively treated with

pesticide. No signs of the insect have been found in subsequent surveys of that property. On January 27, 2023, the USDA Animal and Plant Health Inspection Service confirmed a sample taken from hemlock trees at Crystal Downs Country Club in Lake Township as positive for HWA. NMISN completed a delimitation survey of the country club and surrounding area to determine the extent of the infestation and mark the trees for treatment in the summer of 2023. NWISN has indicated that at this time, due to how long the infestation at Crystal Downs has been there, it is likely that HWA has spread elsewhere in the county, and it's just a matter of identifying future infestations. The NMISN is working in partnership with the Leelanau Conservancy to delineate the infestation and identify ways HWA is spread.

Local lake management associations are the primary method of preventing, monitoring and treating aquatic invasive species on inland lakes. Eurasian watermilfoil is a particular concern. The following lake associations are present in Leelanau County:

- Leelanau Lake Association and the Friends of Lake Leelanau (Townships of Leland, Centerville, Bingham, Elmwood and Solon). The Grand Traverse Band of Ottawa and Chippewa Indians (GTB) partners with the LLA for water quality monitoring and treatment. Since surveying the lake and discovering the extent of the infestation in Lake Leelanau in 2020, LLLA and GTB have spent an enormous amount of time and money actively controlling EWM with the use of benthic barriers. Focus has been placed on preventing EWM from spreading into North Lake Leelanau, where it has not yet been discovered, and on tackling the largest infestations that have the highest ability to produce fragments and spread the infestation.
- The Glen Lake Association (Townships of Glen Arbor, Cleveland, Empire and Kasson) strives to prevent, monitor, and control or eradicate both aquatic and terrestrial-based invasive species on Big Glen Lake and Little Glen Lake. Thanks to the Association's Boat Wash Program, the lakes remain largely free of invasive species, including EWM. They also perform drone surveys to monitor the land and the water for the presence and spread of invasive plant species.
- Lime Lake Association (Cleveland Township) – as of 2022, no invasive plant species (especially EWM were identified in a comprehensive survey of aquatic gardens in the lake.
- Little Traverse Lake Property Owners Association (Cleveland Township) - EWM has not been found yet in LTL. The current prevention strategy includes a newly installed self-serve boat cleaning station and regular surveys by Freshwater Solutions, which will identify all of the lake's aquatic vegetation and the location of any invasive plants so that rapid eradication efforts can begin immediately. Additionally, a yearly plant survey by Freshwater Solutions will also identify invasive wetland plants including new stands of Purple Loosestrife (PL) and invasive Yellow Iris. Volunteers continue to dig out these invader species as well as cutting and disposing of flower stalks in order to prevent the release of seeds in select locations. Targeted spraying of aquatic approved herbicides may be required for large and persistent stands of PL.
- Cedar Lake Association (Elmwood Charter Township)
- South Bar Lake Association (Empire Township and the Village of Empire)

On a regional level, the following terrestrial invasive species are causing significant harm in the northwestern Lower Peninsula:

- Japanese knotweed, Giant knotweed and Bohemian knotweed, *Polygonaceae,* can be a concern to homeowners and municipalities because of these plants' ability to grow into a structure's foundation, through sidewalks and road surfaces. These plants can also be spread by root fragments and stem sections. It can create monocultures that shade out desirable vegetation, creating poor habitats for native species. This is of particular concern along water bodies and has been shown to be extremely detrimental to waterways in the Eastern US.
- (Invasive) Phragmites is a large-scale clonal grass that rapidly colonizes wetlands. Phragmites crowds out native plants and alters habitat for native fauna. In doing so, Phragmites also alters human access to water resources and has adverse economic effects, including decreasing property value, inhibiting recreational use, and limiting populations of game species. It can become a fire hazard when it dries down
- Cypress spurge is an erect, herbaceous to semi-woody perennial with bright yellow-green flowers that turn to purple-red as they mature. Cypress Spurge is toxic to horses and cows.
- Black Swallow Wort is a rapidly growing, herbaceous perennial in the Milkweed family. However, Black Swallow Wort is toxic to animals and the monarch butterfly.
- Oriental bittersweet is a vine plant that can strangle a tree and causes tree mortality. This impacts ecosystem health and economic health that is associated with trees' health.
- Autumn olive is very widespread in Michigan. It is spread by birds and is recolonizing old farm fields. Its value to wildlife is relatively low (low in protein and other nutrients compared to our natives). It also is known for its nitrogen-fixing abilities. Specific areas of problematic autumn olive infestation provided by a participant in this plan development include these areas of Forest Home Township: properties along Miley Pointe Drive down to Cottage Drive, and along sections of Steiner Road between Clam Lake Road and SE Torch Lake Drive.

- Oak wilt is an infectious vascular disease that can affect all species of oak. Red oaks get the disease more often and succumb more readily than white oak. The disease spreads via root grafts and sap-feeding beetles.
- Beech bark disease is caused by the combination of the *Neonectria* fungus and beech scale. Beech scales are yellow, soft-bodied insects that are 0.5 to 1.0 mm long as adults. The insects, found on the tree trunk and branches, feed on sap in the inner bark. The minute wounds caused by the scale insects eventually enable the Nectria fungus to enter the tree. The Nectria kills areas of woody tissue.
- Garlic mustard is an herbaceous biennial, up to 4 feet in height. Forms round basal rosette the first year, flowers the second year and dies. Grows in forests, particularly floodplain forest, open wetlands, parking lots, campgrounds, paths, and roadsides.

On a regional level, the following aquatic invasive species are causing significant harm in the northwestern Lower Peninsula:

- Didymo or "rock snot" is an aquatic diatom that is brown, tan, or yellow in color. Unlike most algae, it feels like wet cotton and is not slimy. Grows in rivers, streams, and lakes. It occurs particularly in cool, oligotrophic, clear water.
- Purple loosestrife is an herbaceous wetland perennial reaching 5 feet with reddish-purple flowers with five to seven petals are held in dense terminal cluster. Grows in moist soils, in wet meadows and prairies, shallow marsh, ditches, waste areas, and along lakes, ponds, streams, and rivers.
- Eurasian water-milfoil is a submergent, aquatic perennial that reached 3-10 feet or more in length. Grows in ponds, lakes, and low-energy zones in rivers and streams. Specific areas of autumn olive infestation provided by a participant in this plan development include Six Mile Lake in Echo and Banks Townships, the Clam River and Alden Harbor on Torch Lake.
- New Zealand mudsnail is an aquatic mollusk with an elongated shell 1/8 inch long with 7-8 whorls. Shell color varies from gray and dark brown to light brown. Grows in flowing freshwater with silt/sand to very brackish rivers; lives in water as deep as 60 feet in lakes or reservoirs.
- Red swamp crayfish is an aquatic crustacean with a dark red body and claws with spiky, bright red bumps, and black wedge-shaped stripe on underside. Grows in flowing to non-flowing freshwater or salt water; permanent ponds; areas of streams and ditches with organic debris; agricultural areas; wetlands.
- Zebra mussel is an aquatic mollusk with striped shells or dark or light shells with no stripes. They attach to objects (pipe, boats, etc.) causing major damage as colonies can block pipes, affecting power and water-treatment plants.

Many of the species listed above are monitored and managed by NMISN. However, the list of all invasive species impacting the county and region is extensive and many established species are treated on a case-by-case basis. Other species of concern include: Honeysuckle (non-native), Glossy buckthorn, Common buckthorn, Wild parsnip, Multiflora rose, and Periwinkle.

Probability of Future Events and Vulnerability Assessment

The State TIS Management Plan provides a list of eleven terrestrial species on the watch list. The invasive species included on the watch list are priority species that have been identified as posing an immediate and significant threat to Michigan's natural resources. These species have either not been confirmed in Michigan, have very limited distribution or are localized. Early detection and timely reporting of occurrences of these species is crucial for increasing the likelihood of stopping an invasion and limiting negative ecological and economic impacts. This list is reviewed and updated periodically, and the most current list is available at www.michigan.gov/invasives.

Common Name Scientific Name Category

1. Asian longhorned beetle *Anoplophora glabripenni* Insect
2. Asiatic sand sedge *Carex kobomugi* Plant
3. Balsam woolly adelgid *Adelges piceae* Insect
4. Chinese yam* *Dioscorea oppositifolia* Plant
5. Hemlock woolly adelgid* *Adelges tsugae* Insect
6. Himalayan balsam* *Impatiens glandulifera* Plant
7. Japanese stiltgrass* *Microstegium vimineum* Plant
8. Kudzu* *Pueraria montana* Plant
9. Mile-a-minute weed *Persicaria perfoliata* Plant
10. Nutria *Myocastor coypus* Mammal
11. Thousand Cankers Disease *Geosmithia morbida Pityophthorus juglandis* Tree Disease

Local land and water management groups are also monitoring for the presence of other Michigan Watch List invasives:

- Spotted lantern fly which impacts fruit and winery production. Winery and fruit production issues can impact agri-tourism.
- Hydrilla is an aquatic, perennial plant that forms dense mats in slow-moving water of lakes, ponds, stream, and rivers.
- European frog-bit is an aquatic, floating, herbaceous annual that forms large colonies, creating dense mats. Grows in open, still waters.
- Parrot feather water-milfoil is an aquatic, herbaceous perennial that can grow 6.5-16.5 feet in length and forms monotypic stands. Grows in lakes, ponds, slow streams, and mudflats, where the emergent form is found.
- Starry stonewort is an aquatic microalga which forms dense mats that cover lake bottoms. Grows in still or slow moving waters.
- Asian Carp (bighead, black, grass, and silver carp) are in direct competition with native aquatic species for food and habitat. Their rapid population increase is disrupting the ecology and food web of the large rivers of the Midwest.
- Beech leaf disease causes dark stripes or banding between leaf veins. A nematode (microscopic worm) is associated with symptoms. Ongoing research is investigating the possibility of other contributing microorganisms.

Leelanau County's natural resources are highly vulnerable to invasive animals, plants, and diseases. NMISN, the Leelanau Conservation District, lake associations and other partners protect, enhance, and promote Leelanau County's natural resources through invasive plant management, education, and outreach. Natural resources that are prioritized for protection include high-quality natural areas such as:

- Coastal dunes along Lake Michigan
- Wetlands, waterways and riparian areas (e.g. Victoria Creek in Solon Township; Lake Leelanau; and Lake Michigan)
- Forested areas (e.g. Clay Cliffs Natural Area in Leland Township; eastern hemlock forests in the Sleeping Bear Dunes National Lakeshore in the Village of Empire, Empire Township, Glen Arbor Township, Cleveland Township, and Centerville Township.

Many local governments in Leelanau County have updated their ordinances in an effort to maintain native plant species and reduce or eliminate the introduction of invasive species. For example, Empire Township has adopted an Aquatic Nuisances Ordinance. Additionally, the communities listed below have revised their zoning ordinances to include invasive plant species prevention strategies by requiring or strongly encouraging landscaping to include only native plantings:

- Bingham Township Zoning Ordinance, Article 3: General Provisions Section 3.12.11 Landscape Elements
- Centerville Township Zoning Ordinance, Sections 9.4.B.d, and 14.2.4
- Cleveland Township Zoning Ordinance No. 2021-1: Amendment To Article IV General Provisions, Section 4.27 Watershed Protection
- Elmwood Charter Township, Article 6: Site Development, Section 6.4.2 General Landscaping Requirements
- Leelanau Township Ordinance #6 of 2018; Amendment of Article 17, Section 17.3 Landscaping & Fencing
- Leland Township Zoning Ordinance, Article 23 Landscaping and Screening, Section 23.07 Minimum Standards of Landscape Elements
- Suttons Bay Township Zoning Ordinance Article 3: General Provisions Section 3.10.5 Standards and Criteria
- Village of Empire Zoning Ordinance Article 3 General Provisions, Sections: 3.18.8; 3.21.1A; 3.13.3D; 3.13.9; 3.13.12
- Village of Suttons Bay Zoning Ordinance Article 2 General Provisions, Section 2-6 Environmental Protection, A1, F2, G; Article 11 Landscaping and Lighting Requirements, Section 11-2 General Requirements, C-1
- City of Traverse City Zoning Code – Chapter 1364, Special Land Use Regulations; Chapter 1372 Landscaping

The impact of invasive species is currently being felt and may become catastrophic for Leelanau County's natural resources, agriculture, recreation, tourism, and economy with the introduction of additional invasive species on the watch list or unchecked existing invasive species.

Climate Change

Climate describes the average weather conditions for a particular location and over a long period of time. The changing climate impacts society and ecosystems in a broad variety of ways. For example, climate change can alter rainfall, influence crop yields, affect human health, cause changes to forests and other ecosystems, and even impact our energy supply. Climate-related impacts are occurring across the country by increasing the severity of storms and weather-related events. Natural disasters then have a direct impact on our economy.

According to a new comprehensive report from the World Meteorological Organization (WMO), "A disaster related to a weather, climate or water hazard occurred every day on average over the past 50 years – killing 115 people and causing $202 million (US $) in losses daily The number of disasters has increased by a factor of five over the 50-year period, driven by climate change, more extreme weather and improved reporting. But, thanks to improved early warnings and disaster management, the number of deaths decreased almost three-fold[7]" (World Meteorological Organization, 2021).

The impacts of climate change already are, and continue to be, deep and widespread in the Great Lakes Region and Michigan as a whole. The National Climate Assessment (NCA) assesses the science of climate change and variability and its impacts across the United States, now and throughout this century. Chapter 21 of the NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States reports,* the Great Lakes influence regional weather and climate conditions and impact climate variability and change across the region. The lakes influence daily weather by:

1) Moderating maximum and minimum temperatures of the region in all seasons,
2) Increasing cloud cover and precipitation over and just downwind of the lakes during winter, and
3) Decreasing summertime convective clouds and rainfall over the lakes.

The Great Lakes Integrated Sciences and Assessments (GLISA) is one of 11 NOAA Regional Integrated Sciences and Assessments teams that focus on helping the nation prepare for and adapt to climate variability and change. A summary of findings from NCA and the GLISA report, *Climate Change in the Great Lakes Region*[8], are provided to show the impacts of climate change throughout the state of Michigan.

Temperature
Warm-season temperatures are projected to increase more in the Midwest than any other region of the United States.[9] Since 1951, annual average air temperatures have increased by 2.3°F (1.3°C) in the U.S., Great Lakes region. By mid-century (2050), average air temperatures are projected to increase by 3°F to 6°F (1.7°C to 3.3°C). By end of century (2100), average air temperatures are projected to increase by 6°F to 11°F (3.3°C to 6.1°C).

The frost-free season is projected to increase 10 days by early this century (2016–2045), 20 days by mid-century (2036–2065), and possibly a month by late century (2070–2099) compared to the period 1976–2005 according to the higher scenario (RCP8.5).[10]

Precipitation
Since 1951, total annual precipitation has increased by 14% in the U.S., Great Lakes Region. Future projections suggest more precipitation on average, but not necessarily during all seasons (summer to be drier) and not for all locations depending on which model is used. Reduced lake ice cover and enhanced evaporation may lead to increased lake-effect snowfall in the near-term, but rising temperatures will cause more winter precipitation to fall as rain as opposed to snow across the region by late century.

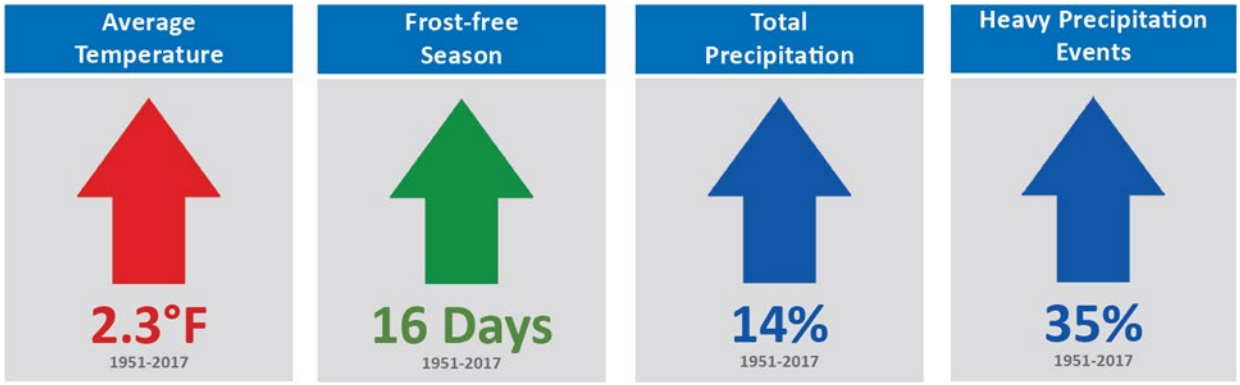
[7] *World Meteorological Organization*. (2021, August 31). Retrieved from Weather-related disasters increase over past 50 years, causing more damage but fewer deaths: https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer

[8] (2019, February 14). Retrieved from Climate Change in the Great Lakes Region: https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Pager.pdf

[9] Vose, R. S., D. R. Easterling, K. E. Kunkel, A. N. LeGrande, and M. F. Wehner, 2017: Temperature Changes in the United States. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 185–206. doi:10.7930/J0N29V45.

[10] Hibbard, K. A., F. M. Hoffman, D. Huntzinger, and T. O. West, 2017: Changes in Land Cover and Terrestrial Biogeochemistry. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 277–302. doi:10.7930/J0416V6X.

From 1951-2017, the United States, Great Lakes Region, overall, has seen increases in average temperature, frost-free season, total precipitation, and heavy precipitation events.



Snow, Ice Cover and Lake Temperature
Summer lake surface temperatures have been increasing faster than the surrounding air temperatures, with Lake Superior increasing by 4.5°F between 1979 and 2006. Annual average ice cover on the Great Lakes shifted from higher amounts prior to the 1990s to lower amounts in recent decades. There remains strong year-to-year variability, and high ice years are still possible. Lake-effect snowfall has increased in northern areas and may continue to increase through mid-century.

Extreme Weather
The frequency and intensity of severe storms has increased. This trend will likely continue as the effects of climate change become more pronounced. The amount of precipitation falling in the heaviest 1% of storms increased by 35% in the U.S. Great Lakes region from 1951 through 2017. More severe storms may have a negative economic impact due to resulting damages and increased costs of preparation, clean up, and business disruption.

The NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States, "*Climate change is transforming where and how we live and presents growing challenges to human health and quality of life, the economy, and the natural systems that support us. Risks posed by climate variability and change vary by region and sector and by the vulnerability of people experiencing impacts. Social, economic, and geographic factors shape the exposure of people and communities to climate-related impacts and their capacity to respond. Risks are often highest for those that are already vulnerable, including low-income communities, some communities of color, children, and the elderly" (*Ch. 14: Human Health, KM 2*; *Ch. 15: Tribes, KM 1–3*; *Ch. 28: Adaptation, Introduction*).

A vulnerability assessment can be found in the two-page report: *Climate Change in the Great Lakes Region* by GLISA at https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Pager.pdf. The report identifies key challenges from climate change such as:

- **Public Health**
  - Increased risk of heat waves and increased humidity may amplify the number of heat-related deaths and illnesses.
  - More storm activity and flooding, resulting in increased point- and non-point source pollution, will likely increase watershed contamination and water-borne illnesses, while warmer surface waters amplify the risk of toxic algal blooms and fish contamination.
- **Tourism and Recreation**
  - *Winter recreation/tourism are likely to suffer* due to reduced snow cover and shorter winters. Reduced lake ice cover and enhanced evaporation may lead to increased lake-effect snowfall in the near-term, but rising temperatures will cause more winter precipitation to fall as rain as opposed to snow across the region by late century.
  - Increasing temperatures and a longer summer season may *increase the demand for lake and beach use*.
  - Overall, *summer tourism may grow before temperature rise becomes unfavorable* for outdoor recreation.
  - *The fishing industry* (commercial and recreation) is likely to be impacted by the *decline of coldwater species of fish, such as lake trout and whitefish*.

- **Natural Environment**
  - Despite increasing precipitation, land surfaces in the region are expected to become drier overall due to increasing temperatures and evaporation rates.
  - More frequent summer droughts could affect soil moisture, surface water, and groundwater supply.
  - Increased evaporation rates and sustained levels of high or low water levels may change wetland areas in the region.
  - The rate of warming may *outpace the rate at which ecosystems are able to migrate and adapt*.
  - *Wildlife populations better adapted to cold temperatures will continue to decline* as competing species migrate into the region with rising air and surface water temperatures.
  - *Forest productivity will likely increase in the short term*, until other impacts of climate change such as increased drought, fire and invasive species present additional stressors to forests.

V. Community Vulnerability Analysis

The Community Vulnerability Analysis tables on the following pages summarizes much of the information presented in Sections III (Community Profile) and IV (Hazard Identification and Assessments) of this plan as it pertains to each community in Leelanau County. While many types of hazards considered in this plan could affect every jurisdiction in the County, certain characteristics of people, property, the economy and the environment were considered to evaluate each community's unique vulnerabilities (as well as assets) for each type of hazard. For reference, the locations of some of these characteristics (i.e., public lands, pine forest area, infrastructure, and specific hazard areas identified by stakeholders in the planning process) are illustrated in the maps provided in Appendix A.

Community Vulnerability Analysis for Leelanau County

	Leelanau County Townships/City												Leelanau County Villages		
	Bingham	Centerville	Cleveland	Elmwood	Empire	Glen Arbor	Kasson	Leelanau	Leland	Solon	Suttons Bay	City of Traverse City	Empire	Northport	Suttons Bay
Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Severe Winter Weather and Extreme Temperature Vulnerabilities															
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Communications Critical Infrastructure	2	1		7	1	1	1	3	2	1	2			1	1
Est. number of residents age 65+	666	355	385	1,232	447	344	337	830	565	402	927	12			
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	128	19	21	204	35	27	48	130	51	34	522	0			
Est. # of residents that are of Hispanic or Latino origin and a minority race	78	0	0	15	0	0	3	18	6	7	183	0			
Est. # of households that are lower income (ALICE or below poverty level)	410	235	231	846	246	74	308	469	257	291	507				

Community Vulnerability Analysis for Leelanau County

	Leelanau County Townships/City												Leelanau County Villages		
	Bingham	Centerville	Cleveland	Elmwood	Empire	Glen Arbor	Kasson	Leelanau	Leland	Solon	Suttons Bay	City of Traverse City	Empire	Northport	Suttons Bay
Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Thunderstorm, High Winds, Hail, Tornado Vulnerabilities															
Mobile Home Neighborhoods				1									1		
Campgrounds		2			2	4		1	1	1	1				
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Previous Tornadoes			1			1			2		1				
Communications Critical Infrastructure	2	1		7	1	1	1	3	2	1	2			1	1
Est. number of residents age 65+	666	355	385	1,232	447	344	337	830	565	402	927	12			
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	128	19	21	204	35	27	48	130	51	34	522	0			
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	78	0	0	15	0	0	3	18	6	7	183	0			
Est. # of households that are lower income (ALICE or below poverty level)	410	235	231	846	246	74	308	469	257	291	507				
Lightning Vulnerabilities															
Campgrounds		2			2	4		1	1	1	1				
Communications Critical Infrastructure	2	1		7	1	1	1	3	2	1	2			1	1
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Community Vulnerability Analysis for Leelanau County

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Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Flooding Vulnerabilities															
Inland Flood Concern Areas	X	X	X	X		X	X	X	X	X	X				
FEMA FIRM issued	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Potential dam failure (for dams that have a condition rating)				Cedar Lake Dam (Significant); Meeuwenberg Dam (High)					Leland Dam (High)		Belanger Dam (Low)				
# of Road/Stream Crossings with a Moderate to Severe Rating	3 Moderate, 1 Severe			8 Moderate, 17 Severe				14 Moderate, 14 Severe			5 Moderate, 11 Severe				
# of Bridges with Poor, Serious, Critical or Closed Ratings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Est. number of residents > age 65	666	355	385	1,232	447	344	337	830	565	402	927	12			
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	128	19	21	204	35	27	48	130	51	34	522	0			
Est. # of residents that are of Hispanic or Latino origin and a minority race	78	0	0	15	0	0	3	18	6	7	183	0			
Est. # of households that are lower income (ALICE or below poverty level)	410	235	231	846	246	74	308	469	257	291	507				

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Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Shoreline Hazards															
Critical Dune Areas		X	X		X	X		X	X				X		
High Risk Erosion Areas	X					X		X	X		X		X		
Shoreline Erosion Concern Areas	X			X	X	X	X (Glen Lake)	X	X		X		X		X
Coastal Flooding Concern Areas	X			X		X		X	X		X				
Dangerous Currents (potential or prior incident)	X	X	X	X	X	X		X	X		X	X	X	X	X
Seiche (previous or potential)	X	X	X	X	X	X		X	X	X	X	X	X	X	X
FEMA FIRM issued	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Wildfire Vulnerabilities															
Pine Forest	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Campgrounds		2			2	4		1	1	1	1				
Fire Hazard Concern Areas		X	X	X	X	X	X	X	X	X			X		
Est. number of residents age 65+	666	355	385	1,232	447	344	337	830	565	402	927	12			
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	128	19	21	204	35	27	48	130	51	34	522	0			
Est. # of residents that are of Hispanic or Latino origin and a minority race	78	0	0	15	0	0	3	18	6	7	183	0			
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Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Lake Associations	X	X	X	X	X	X	X		X	X			X		
Native Plantings Encouraged or Required per Zoning Ordinance	X	X	X	X				X	X		X	X	X		X
Aquatic Nuisances Ordinance					X										
Drought Vulnerability															
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fire Hazard Concern Areas		X	X	X	X	X	X	X	X	X			X		
Agricultural Land	X	X	X	X	X	X	X	X	X	X	X		X		
Invasive Species Concerns															
Areas mapped as a locations of particular concern	Lake Leelanau	Lake Leelanau; Lake MI Coast	Lake MI Coast	Lake Leelanau	Lake MI Coast	Lake MI Coast			Lake Leelanau	Lake Leelanau	Lake Leelanau		Lake MI Coast		

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Population Estimates (2019)	2,496	1,449	1,197	4,497	1,161	668	1,457	2,007	1,756	1,747	2,985	232	263	457	544
Community Assets															
Fire/EMS Stations				2		1			2	1	1		1	1	1
Police/Sheriff Stations											2				
Fire, EMS, and Law Enforcement Coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shelter Sites				1			2		3	1	1		2	2	2
Medical Clinics				1					2		1	1	1		2
Public Health Emergency Vulnerabilities															
Assisted Living Facility				3			1		1		1			1	1
Est. number of residents age 65+	666	355	385	1,232	447	344	337	830	565	402	927	12			
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	128	19	21	204	35	27	48	130	51	34	522	0			
Est. # of residents that are of Hispanic or Latino origin and a minority race	78	0	0	15	0	0	3	18	6	7	183	0			
Est. # of households that are lower income (ALICE or below poverty level)	410	235	231	846	246	74	308	469	257	291	507				

VI. Goals and Objectives

The mission of the Leelanau County Natural Hazards Mitigation Plan is to protect the health and safety of the public and property in the County which includes prevention of injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, maintain tourist base, and liability issues. This is done by taking action to permanently eliminate or reduce the long-term risks from natural hazards.

Specific goals and objectives have been established based upon the community's natural hazards analysis, as well as input from the Task Force participants and the public through meetings, request for comments on the draft plan, and the presentation of the plan to the Local Emergency Planning Team.

Goal 1: Increase whole community participation, strategies, and initiatives in natural hazard mitigation

- Encourage cooperation and communication between planning and emergency management officials
- Encourage additional local governmental agencies to participate in the hazard mitigation process
- Encourage public and private organizations to participate, including organizations who advocate for individuals with functional or access needs
- Encourage use of the "Firewise Communities Program" (www.firewise.org) which offers both workshopsand web-based interactive training geared toward homeowners, forestry professionals, firefighters and others on a variety of wildfire safety topics.

Goal 2: Integrate hazard mitigation considerations into the community'scomprehensive planning process

- Enforce and/or incorporate hazard mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- Create or update zoning ordinances to reflect any new regulations
- Incorporate hazard mitigation into basic land use regulation mechanisms
- Incorporate hazard area classifications into standard zoning classifications
- Develop community education and warning systems
- Integrate hazard mitigation into the capital improvement planning process so that public infrastructure does not lead to development in hazard areas
- Encourage county agencies to review local roads, bridges, dams, and related transportation infrastructure for hazard vulnerability

Goal 3: Utilize available resources and apply for additional funding for natural hazards mitigation projects

- Provide a list of desired community mitigation measures to the State for possible future funding
- Encourage the application for project funding from diverse entities

Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

- Encourage public and business involvement in natural hazards mitigation projects

VII. Mitigation Strategies and Priorities

Types of Mitigation Actions

The mitigation planning regulations requires that each participating jurisdiction identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the impacts of the hazards identified in the risk assessment. The emphasis is on the impacts or vulnerabilities identified in the risk assessment, not on the hazards themselves. The types of mitigation actions can be classified into the following types:

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

Furthermore, a set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems in Leelanau County.

- The measure must be technically feasible.
- The measure must be financially feasible.
- The measure must be environmentally sound and not cause any permanent, significant environmental concerns.
- The measure must be acceptable to those participating in the strategy and/or primarily affected by the strategy.

By anticipating future problems, the County can reduce potential injury, structure losses, loss of utility services such as electric and internet connectivity, and prevent wasteful public and private expenditures. The County Infrastructure, Vulnerability, and Hazard Maps in Appendix A can assist with the determining future problem areas.

Emergency Warning System Coverage

- Mobile warning system: RAVE Mobile Alert System; IPAWS (Integrated Public Alert and Warning System - FEMA's national system for local alerting that provides authenticated emergency and life-saving information to the public through mobile phones using Wireless Emergency Alerts, to radio and television via the Emergency Alert System, and on the National Oceanic and Atmospheric Administration's Weather Radio.)

- Radio warning system: Leelanau County uses radio channels 580 AM and 103.5 FM for emergency weather alerts.

- Tornado/Severe Weather Systems: Manual sirens are located at fire departments: Suttons Bay, Leland, Elmwood, Northport, Cedar, and Glen Lake and one warning siren located in Peshawbestown at the Pow Wow Grounds on Stallman Road for the Grand Traverse Band of Ottawa and Chippewa Indians.

- Flood warning system: The Leland Dam has an alarm and monitoring system for dam failures/flooding. Other dams do not.

Leelanau County Office of Emergency Management maintains contracts with many local fire stations, township halls, and community facilities in the county so that they may be utilized as temporary shelters in the event of an emergency. Those are:

Emergency Shelter Site Name	Street Address	City	ZIP	Generator (Y/N)	Overnight Accommodations (Y/N)
Cedar Area Fire & Rescue	8907 S. Railroad Avenue	Cedar	49621	Yes	No
Elmwood Township Fire & Rescue	10090 E. Lincoln Road	Traverse City	49684	Yes	No
Empire Township Hall	10088 W. Front St.	Empire	49630	Yes	No
Glen Lake Community Library	10115 W. Front St.	Empire	49630	Yes	No
Glen Lake Fire Department	6401 W. State Street	Glen Arbor	49636	Yes	No
Leland Township Fire & Rescue	503 S. Grand Avenue	Leland	49654	Yes	No
Leelanau Township Fire Department	100 W. 8th Street	Northport	49670	Yes	No
Suttons Bay-Bingham Fire & Rescue	201 S. St. Mary's Street	Suttons Bay	49682	No	No
Leelanau Sands Casino	2521 N. West Bay Shore Drive	Peshawbestown	49682	Yes	No
Northport Public School	104 S. Wing Street	Northport	49670	Yes	No
Leland Public School	200 N. Grand Avenue	Leland	49654	Yes	No
Suttons Bay Public School	500 S. Elm Street	Suttons Bay	49682		No
Glen Lake Public School	3375 W. Burdickville Road	Maple City	49664	Yes	No
VFW Post 7731	7475 E. Duck Lake Road	Lake Leelanau	49653	No	No
Cedar/Maple City Lions Club	100 E. Bellinger Road	Maple City	49664	No	No

Mitigation Strategies
Strategies were developed based on discussions with local officials and a review of FEMA best practices for hazard mitigation. A list of alternative strategies considered is included as Appendix D. The strategies table is grouped according to purpose. Purpose types include: Awareness & Preparation, Shelters, Buildings & Infrastructure, Utilities & Technology, and Environment & Natural Resources. The table also includes: a description of each strategy; what natural hazards they address; where the strategy applies; who is responsible for implementing the strategy; how the strategy will be implemented (what resources are available to help execute the strategy); when the strategy could feasibly begin; the level of priority; and what type of strategy it is. Strategies are intended to be action items completed during the 5-year timeframe in which the plan is active. Some strategies may extend beyond the 5-year timeframe due to feasibility or level of difficulty.

Appendix C provides a review of mitigation strategies included in the 2016 plan, their current status, and how they have or have not been incorporated into the 2023 plan. The assigned priority levels for the 2016 strategies are also compared to what the 2023 plan has assigned for them. The 2016 plan simply identified the top five most significant priority areas by geography and vulnerability to specific types of hazards. The general rationale used to determine the priority levels of strategies in the 2023 plan differs greatly, as hazards are not prioritized based on geography, and is described on page 98.

Funding the Implementation of the Strategies
To assist with the funding of the proposed natural hazards mitigation strategies, a list of potential financial assistance entities and programs to help fund the implementation projects of the Plan is provided. Other general informational resources are also provided to assist with education and outreach efforts. Each potential entity, program, and resource is assigned a letter code, and the appropriate letter(s) is listed on under the "Resources" column of the strategies table. The following pages include the resources and mitigation strategies tables.

Resources List for Leelanau County 2023 Hazard Mitigation Strategies

ID	Resource	Description	Hazard Type	Website
A	**Leelanau County staff**	Leelanau County staff as appropriate	All hazards	https://www.leelanau.gov/
B	**Local government staff**	All local units of government - employees, elected and appointed officials	All hazards	
C	**Local Emergency Services and Fire Departments**	Cedar Area Fire & Rescue (Solon Twp.); Elmwood Charter Township Fire & Rescue; Traverse City Fire Station (Elmwood Twp.), Glen Lake Fire & Rescue (Glen Arbor Twp.); Leland Township Fire & Rescue (Leland); Lake Leelanau Fire Station (Leland Twp.), Leelanau Township Fire Department; Suttons Bay-Bingham Township Fire & Rescue; GTB Fire & Rescue (Suttons Bay Twp.); Empire Fire Dept. (Village of Empire)	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Wildfire; Flooding; Extreme Temperatures; Public Health Emergency	
D	**Leelanau County Senior Services (LCSS)**	LCSS offers an emergency pendant called the "Freedom Alert". A person wears a small pendant with an emergency call button on it. When there is an emergency, the button is pressed; 9-1-1 is dialed automatically. There is no monitoring fee, service charges or contract. There is a one-time cost to purchase the system. Please contact the LCSS office regarding cost, financial assistance may be available. LCSS also offers a File of Life and the Medical Equipment Loan Closet free of charge. Seniors may receive assistance in paying for snow removal from their driveways/walkways. Other services include: Personal Care; Respite Care; Medication Management; Homemaking; Dental, Eyeglass or Hearing Aid Assistance; Heating/Utility Bill Payment Assistance; Legal Assistance; Unmet Needs Assistance (assistance with unpaid medical, safety related repairs/house/car). Financial assistance for these programs is available to seniors who meet LCSS's income and asset guidelines.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	https://www.leelanau.gov/lcssprograms.asp
E	**Benzie-Leelanau District Health Department (BLDHD)**	Provide programs and services such as: immunizations; community clinics; school health services; well and septic system inspections and permits; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, the inspection and licensing of food service establishments, and emergency scenario preparedness and response training.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	http://www.bldhd.org/
F	**Northern Michigan Community Action Association (NMCAA)**	Weatherization Assistance Program and Emergency Home Repair Program for low- to moderate- income households. Provides food distribution via the following USDA programs: monthly food package to low-income senior citizens via the Commodity Supplemental Food Program (CSFP), and The Emergency Food Assistance Program (TEFAP) to low-income persons through a quarterly distribution.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	https://www.nmcaa.net
G	**"MI HOPE" Grants (Michigan Housing Opportunities Promoting Energy Efficiency)**	Program for up to $25K to repair or replace roofs, doors, windows, insulation, heating/cooling systems, water heaters, security lighting, Energy Star appliances and electrical systems for eligible low-income residents.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	www.michigan.gov/mi-hope

ID	Resource	Description	Hazard Type	Website
H	**Habitat for Humanity Grand Traverse Region**	Provides the Priority Home Repair Program. Provides critical repairs (roofing, foundation, electrical, septic, heating/cooling and accessibility) to a homeowner's house so they can safely stay in their home longer than they might have been able to without the repairs. Requirements: Applicant's income must be under 60% of the Average Median Income (AMI) for the county; must demonstrate a challenging circumstance such as limited income, disability, illness, or age that prevents them from making the repairs; and have owned their home for at least 12 months.	Flooding, Thunderstorms, Hail, High Winds, Severe Winter Weather, Lightning, Extreme Temperatures, Public Health Emergency	https://www.habitatgtr.org/
I	**Grand Traverse Regional Community Foundation**	GTRCF supports a variety of community need areas, including youth, arts and culture, education, environment, and health and human services. We do this by promoting giving, engaging in collaborative leadership, supporting nonprofit organizations through meaningful grants and local students through scholarships, and building endowments that make a lasting impact for generations to come. Service area includes Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau Counties.	Invasive Species, Flooding, Extreme Temperatures, Public Health Emergency	https://www.gtrcf.org/
J	**Groundwork Center for Resilient Communities**	With roots firmly embedded in the pro-health, pro-environment, and pro-economy principles of a local food system, the Groundwork Food and Farming team creates markets for local farmers, and helps connect locally grown food to school children, food pantry clients and families across the state.	Public Health Emergency	https://www.groundworkcenter.org/food-farming/
K	**Midwest Agriculture Climate Team**	MAC-T members are Extension specialists and state climatologists from many of the states represented in the Midwest Climate Hub, and NOAA NWS climate and weather specialists. The goal of this team is to share expertise regionally, discuss impacts and opportunities as it relates to agriculture and outlooks, and maintain an open line of communication so when weather/climate events do occur, the Midwest agriculture community is set to respond. The team meets monthly during the growing season regularly, and as needed during the winter season.	Drought, Extreme Temperatures, Flooding, Severe Winter Weather, High Winds, Hail	https://www.climatehubs.usda.gov/hubs/midwest/topic/midwest-agriculture-climate-team-mac-t
L	**NWS Climate Prediction Center**	The U.S. Drought Monitor is a map released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4).	Drought	https://www.cpc.ncep.noaa.gov/products/Drought/
M	**National Fire Protection Association Firewise USA Program**	Firewise USA Program: Each applicant must create a board/committee, complete a community wildfire risk assessment with a 3-year action plan to reduce ignition risk to homes, and complete annual educational and risk reduction actions identified in the plan.	Wildfire, Drought	https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA
N	**NFPA Community Wildfire Defense Grants**	Communities can use these grants from the USFS in a variety of ways to reduce the wildfire risk to people and property. One key use is capacity building for wildfire mitigation. For example, communities can use the grants to support the implementation and enforcement of wildfire-related codes and standards; to train people to assess wildfire risk and implement effective mitigation measures; and to perform outreach to community members through programs like Firewise USA®. Communities that build these fundamentals—sound land use and building practices, a skilled workforce, and an educated public—will be better prepared for sustained and effective risk reduction and better equipped to take advantage of future federal grants that prioritize communities with codes in place.	Wildfire, Drought	https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire
O	**HMGP Post-Fire Assistance (PFA) grant program**	This grant funds projects that make a community more resilient after a designated wildfire disaster. States and federally-recognized tribes affected by fires resulting in a Fire Management Assistance Grant (FMAG) declaration on or after October 5, 2018, are eligible to apply.	Wildfire, Drought	https://www.fema.gov/grants/mitigation/post-fire

ID	Resource	Description	Hazard Type	Website
P	**Consumer's Energy Utility Services**	Consumers Energy provides electrical and natural gas utility services. Energy through renewable energy sources is available. A power outage map is available to track outage locations.	All hazards.	https://www.consumersenergy.com/outagemap
Q	**Cherryland Electric Cooperative**	Cherryland Electric is a regional cooperative that provides electric service to the majority of Leelanau County. A power outage map is available to track outage locations.	All hazards.	https://cherrylandelectric.coop
R	**Michigan High Speed Internet Office**	Information on plans and funding opportunities to increase high speed internet service in Michigan.	All hazards.	https://www.michigan.gov/leo/bureaus-agencies/mihi
S	**Great Lakes Shoreviewer Tool**	View aerial imagery of Lake MI shoreline and associated risk levels for coastline, infrastructure/roads, and buildings.	Shoreline flooding and erosion	http://www.greatlakesshoreviewer.org/
T	**Northwest Lower MI Coastal Resilience Atlas**	Mapped coastal flooding and coastal erosion based on three future climate scenarios for communities adjoining Lake MI; areas of the shoreline population, by census tract, that are most vulnerable to extreme heat events.	Shoreline flooding and erosion, Extreme Heat	http://www.resilientmichigan.org/nw_atlas.asp
U	**State-designated High Risk Erosion Areas: programs and maps**	High risk erosion areas are those shorelands of the Great Lakes where recession of the landward edge of active erosion has been occurring at a long-term average rate of one foot or more per year, over a minimum period of 15 years.	Shoreline erosion	https://www.michigan.gov/egle/about/organization/water-resources/shoreland-management/high-risk-erosion-areas
V	**State-designated Critical Dune Areas**	Michigan's critical dune program protects the dune resource using alternative construction techniques to reduce the impacts of development on dunes and protects dune vegetation essential to dune preservation and stability. Earthmoving, vegetation removal, and construction activities within a critical dune area are regulated through a permit program.	Shoreline erosion	https://Michigan.gov/CriticalDunes
W	**Michigan EGLE's Coastal Zone Management Program**	A plethora of resources to improve coastal and climate resiliency through both planning and best management projects.	Shoreline flooding and erosion	https://www.michigan.gov/egle/about /organization/water-resources/coastal management
X	**LIAA's Planning for Resilient Communities Program**	Planning for Resilient Communities is a community engagement and technical services program developed by LIAA with numerous statewide partners. The program is helping citizens, local leaders and public officials plan communities that are more resilient to global challenges such as climate variability, extreme weather events and economic challenges. In collaboration with Michigan's Coastal Management Program, *LIAA can help your master plan enhance coastal and community-wide resilience.* Coastal Community Resilience Matching Grants are available. LIAA has also compiled a reference library for coastal resilience zoning using 5 key measures.	Shoreline Flooding, Erosion	http://www.resilientmichigan.org/
Y	**Great Lakes Water Safety Consortium**	A nonprofit community of BEST practice, connecting and serving safety experts & water enthusiasts, educating the public on safer ways to enjoy the water, and encouraging leaders to take bold action to make their shoreline safer for residents and visitors.	Coastal Hazards - rip currents	https://www.greatlakeswatersafety.org/
Z	**EGLE's Wetlands Map Viewer**	The WMV application was created for the Department of Environment, Great Lakes, and Energy to provide the public with quick and easy access to wetland spatial data.	Flooding, Drought, Extreme Temperatures	https://www.mcgi.state.mi.us/wetlands/mcgiMap.html
AA	**FEMA Floodplain Management Resources for Local Government Officials**	How to participate with the NFIP and tools and resources to provide higher standards for floodplain management.	Inland and coastal flooding	https://www.fema.gov/floodplain-management/manage-risk/local

ID	Resource	Description	Hazard Type	Website
BB	**FEMA Flood Mitigation Assistance (FMA) Grant Program**	FMA is a non-disaster, competitive grant program that provides funding to states, local communities, federally recognized tribes. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. • $800 million available in funding for FY22 • Application Period: September 30, 2022, to January 27, 2023 • Period of Performance: 3 Years • Cost-share: 25% non-federal • Severe Repetitive Loss (up to 100% federal) • Repetitive Loss (up to 90% federal) • Priorities are set each fiscal year	Inland and coastal flooding	https://www.fema.gov/grants/mitigation/floods
CC	**FEMA Building Resilient Infrastructure and Communities (BRIC) Grant Program**	BRIC is a non-disaster grant program, which provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Funding has doubled for BRIC to $2.295 billion for FY21. • Caps: States/Territories Allocation and Activities: $2 million; Tribal set-aside: $2 million; National Competition: $2.133 billion • Application Period: September 30, 2022 to January 27, 2023 • Period of Performance: 3 year from start date on Recipient's federal award • Cost-share: 25% non-federal • Economically disadvantaged rural communities are eligible for 10% non-federal • Priorities are set each fiscal year	All hazards	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
DD	**FEMA Hazard Mitigation Grant Program (HGMP)**	HMGP is a post-disaster grant program, where funding is only made available under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas.	All hazards	http://www.fema.gov/grants/mitigation/hazard-mitigation
EE	**State of MI: Resources and Best Practices to prevent and manage invasive species**	Prevention tips and action steps to control or remove invasive species.	Invasive Species	https://www.michigan.gov/invasives/take-action
FF	**EGLE's "NotMISpecies" webinar series**	This webinar series explores how agencies, universities and locally led organizations are working together to protect Michigan's natural resources through the Michigan Invasive Species Program. If you are concerned about the impacts of invasive species or interested in the techniques used to control them, join us as we examine species- specific actions, innovations in research and technology, and programs designed to help communities prevent and manage harmful invasive species.	Invasive Species	https://www.michigan.gov/invasives/take-action
GG	**Michigan Invasive Species Grant Program**	The Departments of Natural Resources, Environmental Quality and Agriculture and Rural Development work together to address strategic issues of prevention, detection, eradication, and control for both terrestrial and aquatic invasive species in Michigan. This program is designed to address strategic issues of prevention, detection, eradication and control for both terrestrial invasive species (TIS) and aquatic invasive species (AIS).	Invasive Species	www.michigan.gov/invasives/grants/misgp

ID	Resource	Description	Hazard Type	Website
HH	**Clean Boats, Clean Waters Program**	Funding from the Michigan Department of Environment, Great Lakes, and Energy and the Great Lakes Restoration Initiative has enabled Clean Boats, Clean Waters to grow into a comprehensive aquatic invasive species boater outreach program. The program's mission\ to prevent new aquatic invasive species introductions and limit their dispersal from water recreation activities through outreach and engagement. The program promotes understanding of boat cleaning practices and regulations through the distribution of educational materials, an online resource library, boat washing demonstrations, grants and partnerships.	Invasive Species	www.canr.msu.edu/clean_boats_clean_waters/index
II	**Michigan State University Extension (MSUE)**	Resources available for: training elected and appointed officials, agriculture and food support programs, and natural resources protections.	Inland flooding, shoreline erosion; Invasive Species; Public Health Emergency	https://www.canr.msu.edu/outreach/
JJ	**MSUE's Michigan Inland Lakes Partnership**	The purpose of the Michigan Inland Lakes Partnership (Partnership) is to engage state and local agencies, Native American Nations, outreach institutions (universities and other educational institutions), non-governmental organizations (NGOs), businesses, industries and citizens in a collaborative effort to ensure the quality, sustainability and ecological diversity of lakes, while considering society's needs. The Partnership will promote communication and cooperation between partners, communities and citizens interested in the management of Michigan's inland lakes, educating leaders, and strengthening stewardship efforts.	Inland flooding, shoreline erosion; Invasive Species	https://www.canr.msu.edu/michiganlakes/convention/
KK	**USDA Natural Resources Conservation Service (NRCS)**	The NRCS helps America's farmers, ranchers, and landowners conserve our nation's resources through voluntary programs and science-based solutions.	Drought; Extreme Temperatures; Invasive Species; Public Health Emergency	https://www.leelanaucd.org/natural-resources-conservation-service.html
LL	**Leelanau Conservation District (LCD)**	The District works closely with Federal, State and local agencies and organizations to promote the wise use of natural resources through information and technical assistance to the landowners and users of Leelanau County. Services include: · Natural Resource Site Visits • County Soil Erosion Permits, including Vegetation Removal Assurance Plan Application for Designated Critical Dune Areas • Forestry Assistance & Referrals • Plant, Insect & Disease Identification • Workshops & Demonstrations, Native Plant Sales	Flooding, shoreline erosion; Invasive Species; wildfire; drought	https://www.leelanaucd.org/
MM	**Northwest Michigan Invasive Species Network (NMISN)**	A Cooperative Invasive Species Management Area (CISMA) serving Benzie, Grand Traverse, Leelanau & Manistee counties to manage populations of invasive species that threaten northwest Michigan's high-quality natural areas through terrestrial invasive plant management and outreach.	Invasive Species	https://www.habitatmatters.org/
NN	**The Watershed Center Grand Traverse Bay**	Advocates for clean water in Grand Traverse Bay and acts to protect and preserve the bay's watershed. Pollution prevention and/ or restoration projects include establishing stormwater management and green infrastructure practices, installing riparian vegetation, naturalizing shorelines and streambanks, and restoring wetlands and hydrologic connectivity. Water quality monitoring projects are implemented in a variety of locations – often through volunteer collaboration – to identify threats, gauge restoration progress, and track changes in water quality over time.	Flooding & Erosion, Coastal Hazards, Invasive Species, Public Health Emergency	https://gtbay.org/

ID	Resource	Description	Hazard Type	Website
OO	**Conservation Resource Alliance (CRA)**	Current projects include: Wild Roots, a cost-share program offering native plants to property owners at a greatly reduced rate; and The River Care Program, which ensures that natural resource professionals maintain a consistent and prioritized action plan for each river in the organization's region. River Care professionals not only find and repair physical problems before they become worse, they also team with local agencies, residents, and interest group representatives for fact-based conversations. These cross-functional teams can speak openly and affect change in an agile, efficient and transparent way. CRA works in the 10-county northwest MI region, along with the southerly adjoining counties of Mason, Lake, Osceola, Oceana and Newaygo.	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency	https://www.rivercare.org/
PP	**Great Lakes Stream Crossing Inventory**	Previously, individual inventories were conducted by partnership agencies, watershed organizations, and road agencies but were not readily accessible to stakeholders and did not contain comparable information. The newly developed protocol and datasheet are intended to promote consistent data collection, selection criteria for improvement projects, and selection of appropriate Best Management Practices for each project to benefit all stakeholders. Information gathered on the datasheet can and has been used to prioritize structure replacement and successfully seek funding.	Flooding & Erosion	https://great-lakes-stream-crossing-inventory-michigan.hub.arcgis.com/
QQ	**Leelanau Lake Association** (Village of Leland; Townships of Centerville, Bingham, Elmwood and Solon)	With more than 500 members and 50 volunteers, the Lake Leelanau Lake Association is dedicated to protecting and enhancing the quality and beauty of Lake Leelanau and its surrounding watershed for current and future generations. Our protection and preservation activities include water quality, lakeshore protection, boating safety, fishing, and swimmer's itch. Currently, our single biggest expense and our primary focus is controlling the existential threat posed to the lake by aquatic weeds, specifically Eurasian Watermilfoil, the most invasive aquatic weed in North America. LLLA also offers free shoreline consultations to help you follow best management practices to protect your shoreline and Lake Leelanau.	Flooding, Erosion, Invasive Species, Public Health Emergency	https://lakeleelanau.org/
RR	**Friends of Lake Leelanau**	Friends is dedicated to protecting and enhancing the quality and beauty of Lake Leelanau and its surrounding watershed for current and future generations. Friends' highest priority is to develop a long-term mechanism to finance the prevention, monitoring and control of invasive species in Lake Leelanau. Gifts to Friends will be placed in an endowment fund. The income generated annually from this endowment will be distributed to fund programs to prevent, monitor and control aquatic invasive species in Lake Leelanau. Should other challenges threaten Lake Leelanau in the future, the income from the endowment may be used to address these as well.	Invasive Species	https://friendsoflakeleelanau.com/
SS	**Glen Lake Association** (Townships of Glen Arbor, Empire, and Kasson)	The Glen Lake Association is been dedicated to protecting, preserving, and caring for the Glen Lake/Crystal River Watershed. Through our work, we aim to be the recognized leader in evidence-based watershed protection strategies while advancing environmental education, sustainable policies, and quality of life. From water quality monitoring and invasive species prevention, to cutting edge research and community-wide education, we are All About the Water!	Flooding, Erosion, Invasive Species, Public Health Emergency	https://www.glenlakeassociation.org/
TT	**Lime Lake Association** (Cleveland Township)	Programs include research and testing, community education and outreach, collaborations with conservation organizations, and more. Their biggest expense is science. They've been conducting, for example, Swimmer's Itch research for three years that also helps them monitor for Eurasian Milfoil (not currently present in the lake). Their research means early detection and the ability to eradicate the invasive species immediately. The association contracts with a lake biologist who monitors water quality, offers free greenbelt consults and educates members on best practices to protect the water.	Flooding, Erosion, Invasive Species, Public Health Emergency	http://www.limelake.org/

ID	Resource	Description	Hazard Type	Website
UU	**Little Traverse Lake Property Owners Association** (Cleveland Township)	The LTLPA establishes on-going programs to promote, educate, and protect the lake and surrounding areas. The Association is specifically involved in, but not restricted to, issues of safety, recreation, water quality, lake level, beach quality, fishing improvement, weed control, watershed, swimmer's itch, water testing, septic system education, and any other matter that might impact the lake or surrounding areas now or in the future.	Flooding, Erosion, Invasive Species, Public Health Emergency	https://littletraverselake.org/
VV	**South Bar Lake Association** (Empire Township and the Village of Empire)	The Village of Empire is fortunate to have an active and well-educated volunteer association, the South Bar Lake Association that has for more than 10 years, participated in the Cooperative Lakes Monitoring Program (CLMP) through the State of Michigan. In addition, every 3-5 years, the Village, working with the South Bar Lake Association, commissions a monitoring study of South Bar Lake to evaluate the health of water, flora and fauna both in the lake and along the shoreline. Recommendations from those studies are reviewed for possible implementation during the in between years.	Flooding, Erosion, Invasive Species, Public Health Emergency	No website.
WW	**The Leelanau Conservancy**	Since 1988, the Conservancy has preserved over 16,000 acres and created 28 Natural Areas for public enjoyment with more than 28 miles of trails. They have also worked with over 190 landowners to protect family farms and cherished private lands with legal agreements called conservation easements. These agreements restrict development and protect the land’s most important natural features. The Conservancy's priorities include: protecting natural lands and water quality; preserving family farms; and caring for the lands they have protected, such as monitoring for invasive species.	Flooding, Erosion, Invasive Species, Public Health Emergency	https://leelanauconservancy.org/

The Emergency Manager and Task Force considered factors like level of need, economic impact, ease of execution/level of effort, cost, and range of benefit (short term, long-term, small group/area, large group/area) when determining the level of priority for each strategy. Strategies that addressed human health, community safety, and protecting property and critical infrastructure were prioritized as high priority strategies. High priority strategies are often action items that focus around education efforts and infrastructure improvements with potentially high costs associated with them. Necessary, but ongoing tasks that provide a direct benefit to the community and natural resources were also categorized as either high or medium priority strategies. Strategies with minimal direct benefit to the community or natural resources were marked as low priority. The resources needed to implement the strategy and the cost of the strategy was taken into account, but not above the need demonstrated.

PRIORITY

HIGH
MEDIUM
LOW

The key for the strategy types in the far right columns are as follows:

STRATEGY TYPES

1	**Local Planning & Regulations**
2	**Building & Infrastructure Projects**
3	**Natural Systems Protection**
4	**Education & Awareness Efforts**

		LEELANAU COUNTY HAZARD MITIGATION STRATEGIES	HAZARD TYPE										WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are listed in **bold**)	HOW - Resources	WHEN - Timeframe	PRIORITY TYPE (High, Med, or Low)	STRATEGY TYPE			
			Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Dangerous Currents	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency							1	2	3	4
Awareness and Preparation	1	**Incorporate the County Hazard Mitigation Plan's strategies** into elements of **County and local master plans.**	X	X	X	X	X	X	X	X	X	Countywide	**Leelanau County Planning Commission; All local jurisdictions**	A, B	Ongoing	H	X	X	X	X
	2	**Continue to pursue interdepartmental cooperation and coordination of police, fire, rescue and EMS services** to achieve community-wide coverage availability.	X	X	X	X	X	X	X	X	X	Countywide	County Sheriff and EM; **local fire/EMS**	C	Ongoing	H	X			
	2a	**Continue to regularly assess fire suppression access points and make improvements as needed**			X							Countywide	**Local Fire Chiefs**	C	Ongoing	M	X	X		
	3	**Continue and strengthen partnerships with local government agencies, businesses and non-profits to provide public education on hazard scenario preparedness and prevention.**	X	X	X	X	X	X	X	X	X	Countywide	**Leelanau County government**	A, B, C	Ongoing	M	X	X	X	X
	3a	**Continue to inform the public about emergency events and shelter sites** via utilization and promotion of the Rave and IPAWS mass notification systems, NWS weather radios (as a good backup plan) and website/social media.	X	X	X	X	X	X	X		X	Countywide	**County EM**	A	Ongoing	M				X
	3b	**Continue the preparedness practice of conducting the annual statewide tornado drill.**		X								Countywide	**County EM**	A	Annually	M	X			X
	3c	**Continue to promote participation in Storm Spotter Training** provided by the NWS.		X								Countywide	**County EM,** NWS	A	Annually	M				X
	3d	**Educate developers and property owners about best building practices to mitigate impacts of natural hazards**	X	X	X	X	X	X				Countywide	**Leelanau County Dept. of Building Safety**	A	1 - 2 Years	H		X		X
	3e	**Share County Road Commission snow removal plan with communities**	X									Countywide	**Leelanau County Road Commission**	A, B	Ongoing	L	X			X
	3f	Utilize resources offered by the Great Lakes Water Safety Consortium to increase beach **safety awareness and incident prevention at Lake MI beaches**					X					Townships of Elmwood, Bingham, Suttons Bay, Leelanau, Leland, Cleveland, Glen Arbor, and Empire; Villages of Empire, Northport, and Suttons Bay	**MDNR; NPS; Local jurisdictions**	Y	1 - 2 Years	L				X
	3g	**Continue to provide public education and awareness activities such as programs and brochures regarding fuel management, fire-resistant vegtation, and fire breaks through the "FireWise" awareness events held at Cedar Area Fire & Rescue**			X							Countywide	County EM, County Building Dept., **Local Fire Depts.**/First Responders, MDNR	M	Ongoing	M				X
	3h	**Continue to provide public education on wildfire prevention at the Leelanau State Park/ campground**			X							Countywide	**MDNR**	M, N	Ongoing	M			X	X

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Awareness and Preparation	5	**Investigate the cost and feasibility of installing new tornado sirens**		X								Countywide	Leelanau County; **Local jurisdictions**	A, B, CC, DD	3 - 5 Years	L			X		X
	6	**Evaluate additional designated sites to temporarily store cleanup debris** from downed trees after storm events.	X	X		X						Countywide	**Community DPWs, County Road Commission,** County EM, Electric Utility Companies	A, B, P, Q	1 - 2 Years	L	X				
	7	**Continue to develop Emergency Action Plans as needed for large public events.**	X	X	X	X	X	X	X		X	Countywide	**County EM**	A	Ongoing	M	X				
	8	**Continue the Leelanau County Senior Services' (LCSS) provision of discounted snow plowing/home repair services, heating/utility/food delivery assistance to qualified seniors, along with a "telephone reassurance" call service** to check on homebound seniors, especially during extreme winter weather events	X	X	X	X		X			X	Countywide	**Leelanau County Senior Services (LCSS), Northern MI Community Action Agency (NMCAA)**	D, F	Ongoing	M	X				X
	9	**Ensure that County residents, particularly vulnerable populations, have access to healthy, affordable food options.**							X	X	X	Countywide	**County EM, NMCAA, local food pantries, school districts, local communities**		Ongoing	M	X	X	X		X
	9a	**Create community gardens in shared open spaces and/or school locations** to promote learning about growing local food, native pollinating plants, and provide access to fresh produce.							X	X	X	Countywide	**Schools, churches, senior living facilities, local governments**	HH	3 - 5 Years	L		X	X		X
	9b	**Continue to provide and improve food assistance programs and emergency food programs** to help communities prepare for unanticipated pandemics, but also increase year-round food accessibility.	X	X		X					X	Countywide	**LCSS; local food pantries; School Districts (school meal programs)**	D, F	Ongoing	L	X				
	9c	**Food rescue programs,** involving public/private partnerships between restaurants, hotels and other venues of large food production, **can partner with local food pantries** to make good food more widely available.	X	X		X					X	Countywide	**LCSS; local food pantries; School Districts (school meal programs)**	J, I	1 - 2 Years	L	X				X
	10	**Continue collaboration amongst the Benzie-Leelanau District Health Department with federal, state, and local partners to coordinate the response to COVID-19 and other issues pertaining to public health**				X		X			X	Countywide	**Benzie-Leelanau District Health Dept. (BLDHD)**; County EM	E	Ongoing	H	X				X
	10a	**Continue to coordinate with the MDHHS for guidance** via their **State Pandemic Plan** and information about **new or emerging disease threats.**									X	Countywide	**BLDHD**; County EM	E	Ongoing	H	X				X
	10b	**Maintain proper levels of PPE** for healthcare workers and first responders, with additional supplies for long-term care facilities.									X	Countywide; Local fire stations and EMS services; assisted living facilities	County EM; **local fire/EMS; assisted living facilities**	A, C	Ongoing	H	X				

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Awareness and Preparation	11	**Identify flood-prone areas and areas that have reported repetitive loss damages due to flooding on FIRMs and pursue FEMA hazard mitigation assistance grants related to flood mitigation**, such as innovative stormwater management solutions, property acquisition, structure demolition or relocation, dry flood proofing, structure elevation, or project scoping (engineering, environmental, feasibility, and/or benefit-cost analysis)				X	X					Countywide	**County EM**; Road Commission; **Drain Commissioner**; Local Jurisdictions; MI EGLE	Z, AA-CC	1 - 2 Years	H	X	X	X	X
	12	**Promote education about the benefits of natural shoreline and streambank restoration; identify priority shoreline and streambank restoration sites.**				X	X			X		Countywide	**Leelanau Conservation District; The Watershed Center Grand Traverse Bay; Lake Associations**	II, JJ, LL - OO	1 - 2 Years	H	X		X	X
	13	**Consider developing a drought communication plan and early warning system** to facilitate timely communication of local drought conditions/outlook to officials, decision makers, emergency responders, and the general public.							X			Countywide	**County EM,** LCD/USDA-NRCS, Local governments	K, L, KK, LL	1 - 3 Years	M	X			X
	14	**Consider developing agreements for secondary water sources** that may be used during drought conditions.							X			Countywide	**County EM,** LCD/USDA-NRCS, local fire depts.	K, L, KK, LL	3 - 5 Years	L	X			
	15	**Consider establishing an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water.** Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge of groundwater.							X			Countywide	County EM, **LCD/USDA-NRCS**	K, L, KK, LL	3 - 5 Years	L	X		X	
	16	**Consider implementing mandatory water conservation measures during drought emergencies, such as:** •Developing an ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc. •Adopting ordinances to prioritize or control water use, particularly for emergency situations like fire fighting.			X				X			Countywide	County EM, USDA-NRCS, **local governments**	K, L, KK, LL	1 - 3 Years	L	X			
	17	**Continue collaboration with MSUE to provide information on agriculture management and best practices in drought situations.**							X			Countywide	**LCD/USDA-NRCS**, County EM, MSUE	II, KK, LL	Ongoing	M			X	X
	18	**Continue the USDA - NRCS's provision of free technical assistance such as the Conservation Stewardship Program, resource assessment and monitoring, and determination of financial assistance for local farmers, ranchers and forest managers in the wake of a natural disaster.**	X	X	X	X	X	X	X	X	X	Countywide	**LCD/USDA-NRCS**	KK, LL	Ongoing	M			X	X

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Shelters	19	**Maintain an accurate inventory of emergency shelter sites (overnight vs. daily use types);** review annually and update as needed.	X	X	X	X	X	X			X	Countywide	**County EM**; American Red Cross	A	Annually	H	X			
	20	**Support Leland School designation as a Red Cross Shelter site.**	X	X	X	X	X	X			X	Leland Township	**County EM**; Leland Public Schools	CC, DD	Ongoing	H	X	X		
	21	**Provide full generator coverage at shelter locations** (schools, government halls, fire depts.)	X	X	X	X	X	X			X	Countywide	**County EM**; Public Schools; Local Governments	CC, DD	1 - 3 Years	H		X		
	21a	**Provide local governments or public/private organizations information on funding sources for the installation of generators to enhance capabilities of emergency shelter locations.**	X	X	X	X	X	X			X	Countywide	**County EM**; Local Fire Depts; Senior Centers; Municipal Offices	CC, DD	0 - 1 Year	H		X		X
	22	**Evaluate the feasibility and need to construct storm shelters,** such as concrete "safe rooms", **at campgrounds, outdoor recreation areas, and mobile/modular home communities.**	X	X	X	X		X				Parks are countywide; mobile home communities are in Empire and Elmwood Townships; Campgrounds are in Empire, Glen Arbor, Leelanau, Leland, Centerville, Suttons Bay and Solon Townships.	**County EM**; County Building Dept; local govts; private and public campground managers	CC, DD	1 - 3 Years	H		X		
	23	**Continue to establish areas of refuge and evacuation routes** from campgrounds, outdoor recreation areas, and other **sites of large outdoor events.**	X	X	X	X	X	X			X		**County EM**; private and public campground managers; local fire depts.	A	Ongoing	H	X			X
	23a	**Create signage in public parks/beaches that illustrate the nearest emergency shelter locations.**	X	X	X	X	X	X				Countywide	**County and local governments; MDNR, NPS**	A, B	1 - 3 Years	M				X
	24	**Maintain procedures to create quarantine areas in group living quarters**, such as overnight shelters or assisted living facilities.									X	Countywide	**Local governments, assisted living facilities**	E	Ongoing	M	X			
Buildings & Infrastructure	25	**Review zoning and building codes to improve structural resilience to hazards.** For example: review snow load requirements, lightning protection devices, high-wind and hail protections, and wildland fire risk mitigation practices	X	X	X	X	X	X		X	X	Countywide	**Leelanau County Building Department, Local Governments**	B, M, N, X	Ongoing	H	X		X	
	26	**Continue enforcement of building codes and EGLE permitting requirements by verifying floodplains, EGLE-designated Critical Dune areas and High Risk Erosion Areas** relative to new construction or site modification.				X						Countywide	**County Building Dept., Leelanau Conservation District, EGLE**	U, V	Ongoing	M	X		X	
	27	**Create additional drainage districts within the Leelanau County Stormwater Ordinance to require more detailed soil erosion permits** in an effort to prevent landslide areas and provide for drainage control, grading, debris flow measures and native vegetation placement.				X	X			X		Countywide	**County Drain Commissioner**, County Conservation District	A	5+ Years	H	X		X	
	28	**Continue to enforce the Leelanau County Septic Inspection and Property Transfer Ordinance** to protect public health and prevent or minimize the degradation of groundwater and surface water quality from malfunctioning sewage treatment/disposal systems.				X	X				X	Countywide	**BLDHD**	E	Ongoing	H	X		X	X

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Buildings & Infrastructure	29	**Promote the availability of low-cost residential weatherization and home improvement programs.**	X	X	X	X		X			X	Countywide	**LCSS, NMCAA**	F, G, H	0 - 1 Year	M		X		X
	30	**Evaluate the need/potential to provide reduced-cost program to install air conditioning in the homes of low-income senior citizens.**			X			X			X	Countywide	**LCSS**	D, G, I	1 - 3 Years	M		X		
	31	**Improve ventilation techniques** in areas, facilities, or vehicles that are prone to crowding or that may involve exposure to contagion or noxious atmospheres.									X	Countywide	**Local and county governments, schools, private venues.**	A, B	1 - 3 Years	L	X	X		
	32	**Continue to pursue opportunities for brownfield and blight clean-up activities, including demolition and clearance of vacant, condemned structures, to remove actual and potential sources of land, water and air contamination.**		X	X	X					X	Countywide	**Leelanau County Brownfield Authority;** Local Governments	A	Ongoing	M	X	X	X	X
	33	**Continue to maintain community water and/or sewer infrastructure at acceptable operating standards.**	X	X	X	X	X	X	X		X			B	Ongoing	H	X	X	X	
	34	**Install a new generator for one of the two main water wells in the Village of Empire.** (The current one is over 20 years old, runs on diesel, and has to be manually started.)	X	X	X			X	X		X	Village of Empire	**Village of Empire**	CC, DD	3 - 5 Years	H		X		
	35	**Inventory aging critical infrastructure and prioritize improvements, particularly those in flood-prone locations**	X	X	X	X	X	X	X	X	X	Countywide	**Road Commissioner**, Drain Commissioner, **local governments, public land managers**	S, T, U, W, X, Z, OO, PP	0 - 1 Year	H	X	X		
	36	**Complete infrastructure improvements in areas of high flooding potential,** such as upgrading aging stormwater abatement structures, or replacing undersized/aging culverts and bridges to improve river function and high volume streamflow.	X	X	X	X	X	X	X	X	X	Countywide	**Leelanau County; Leelanau County Road Commission;** Leelanau County Drain Commission; **Local jurisdictions**	AA - DD, NN, OO	3 - 5 Years	H	X	X	X	
	37	**Separate storm and sanitary sewer systems where applicable.**	X	X		X	X				X	Northport Village, Empire Village	**Northport Village, Empire Village**	BB-DD	3 - 5 Years	H		X	X	
	38	**Identify the locations of where backup generators on wastewater pump chambers are needed** to alleviate manual pumping/hauling in the event of a power outage, and **apply for funding.**	X	X		X	X				X	Elmwood Twp., Peshawbestown, Leland Twp., Villages of Empire & Northport	**Local jurisdictions**	CC, DD	1 - 3 Years	H	X	X		
	39	**Continue maintenance of major dams in the county, with updated Emergency Response Plans on file and regular inspections (3 years) completed by EGLE for dams with "High" or "Significant" downstream hazard potential.**				X					X	Leland Twp. (Leland Dam), Elmwood Twp. (Cedar Lake Dam and Meeuwenberg Dam)	**Leelanau County Drain Commission, Elmwood Township, and Cherry Bend Lake Owners**	A	Ongoing	M	X	X	X	
	40	**Plan for future upgrades to the Leland Dam**				X					X	Leland Twp.	**Leelanau County Drain Commission**	A	3-10 years	M	X	X	X	

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	41	**Investigate the cause of seasonal flooding in Spring 2023** near E Rainbow's End Road and M-22, where M-22 is closest to the Bay, in Bingham Twp. Water flooded roadside ditches and dispersed over the road.				X						Bingham Twp.	**Bingham Township, County Road Commission,** MDOT	A, B	0-1 Year	L		X	X	
Utilities & Technology	42	**Continue work amongst the utility companies** (Cherryland Electric, Consumers E.) **to clear vegetation** (particularly diseased or dead trees) **along various road and utility right-of-ways** to minimize power outages and road blockages from storm damage.	X	X	X					X		Countywide	RC, MDOT, local fire, GTB Tribe, **utility companies**	P, Q	Ongoing	H	X		X	
	43	**Continue to maintain effective communications practices between electric utility companies regarding power restoration.** (County EM to post and promote the electrical outage map on social media account.)	X	X	X	X		X				Countywide	**County EM**; Utility companies; County RC	P, Q	Ongoing	M				X
	44	**Investigate opportunities to bury overhead utilities,** such as during new construction or in areas regularly prone to power outages.	X	X	X			X				Countywide	Utility companies; **Site Plan review requirements of local governments**	P, Q, X, BB - DD	1 - 3 Years	H	X	X		
	45	**Document occurrences of electrical interruptions** during storms and **collaborate with electric companies to improve the resiliency of the infrastructure** in these areas.	X	X	X	X		X				Countywide	**Citizen volunteers**, County EM, Utility companies	A, B, P, Q	1- 3 Years	H	X			X
	46	**Update and maintain Continuity of Operations (COOP) plans and alternative "remote work" schedules.**	X								X	County Government and Local Government Agencies; Public Schools	**County Government and Local Government Agencies; Public Schools**	A, B	Ongoing	H	X			
	47	**Continue to expand the availability of high-speed internet service to allow for widely available remote work/learning.**	X								X	Countywide	**Local service providers;** MI High-Speed Internet Office; Leelanau County	R	Ongoing	H	X	X		X
Environment & Natural Resources	48	**Continue to monitor, treat and remove aquatic and terrestrial invasive species.**								X		Countywide	**Leelanau Conservancy, NW MI Invasive Species Network, The Watershed Center at Grand Traverse Bay, NRCS, MSUE, MNDR, NPS and lake associations**	KK - NN, QQ - VV	Ongoing	H	X		X	X
	49	**Continue and improve collaboration regarding technical assistance, outreach and education about aquatic and terrestrial invasive species management.**								X		Countywide		EE-NN, QQ-VV	Ongoing	H			X	X
	49a	**Continue participation in EGLE's annual Great Lakes Aquatic Invasive Species "Landing Blitz" event at public boat launches**, emphasizing the need to Clean, Drain, Dry boats whenever they come out of the water, and Dispose of any unwanted bait in the trash.								X		Glen Lake, Lake Leelanau, Lime Lake, Little Traverse Lake	**Lake Associations**	QQ - VV	Ongoing	M			X	X

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Environment & Natural Resources	49b	**Promote MSUE's "Clean Boats, Clean Waters"** comprehensive aquatic invasive species **boater outreach program;** apply for grant funding to communicate aquatic invasive species prevention information through outreach materials and in-person educational events to boaters.								X		Countywide	**NW MI Invasive Species Network; Lake Associations**	QQ - VV	Annually	M	X		X	X
	49c	**Continue to promote EGLE's "NotMISpecies" webinars and resources on invasives control and management**							X			Countywide	**NW MI Invasive Species Networ**k; Lake Associations	MM, QQ-VV	Ongoing	M			X	X
	49d	**Investigate alternative, effective and less expensive invasive species control measures, such as livestock grazing.**								X		Countywide	**NW MI Invasive Species Network**	MM	0 - 1 Year	H			X	X
	50	**Consider adoption of local ordinances that regulate activities to prevent the introduction of or the contribution to the spread of invasive species,** such as prohibiting the use of invasive species in landscaping and/or vegetative riparian buffers, **and permit treatment of existing infestations.**								X		Countywide	**Local jurisdictions**	X, EE	1 - 3 Years	M	X		X	X
	51	**Coordinate with Benzie Conservation District's AIS program to utilize mobile boatwash stations**								X		Glen Lake, Lake Leelanau, Lime Lake, Little Traverse Lake; Boat access sites on Lake MI	**NMISN**, Leelanau Conservancy	MM, WW	0 - 1 Year	M			X	X
	52	**Consider installing permanent boat wash stations at lake access points and boot wash stations at trail access points.**								X		Countywide	**Lake associations, Local jurisdictions,** MDNR	HH	1 - 3 Years	M			X	X
	53	**Consider implementing spraying programs to control mosquito populations and prevent/reduce mosquito-borne diseases.**									X	Countywide	**Local governments**, BLDHD	B, E	1 - 3 Years	M	X			X
	54	**Continue to identify and prioritize sites for open space protection/preservation, green infrastructure and/or stormwater management, especially in areas prone to flooding or erosion.**				X	X	X		X		Countywide	**Leelanau County; Local jurisdictions; The Leelanau Conservancy**	A, B, WW	0 - 1 Year	H	X		X	X
	55	**Establish a "green infrastructure" link system that connects and expands existing parks, preserves and greenways in the County.**				X	X	X		X		Countywide	**Leelanau County**; Local jurisdictions; TART, Inc., NPS, MDNR	A, B; MDNR Rec Grants	3 - 5 Years	M	X		X	X
	56	**Promote EGLE webinars to educate and inform lakeshore residents about what they can do to help protect their property value and the health of the lake** on which they live by protecting, stabilizing and beautifying their shorelines with nature-based solutions.				X	X					Countywide	**Lake associations; Leelanau Conservation District; NWMISN; Leelanau Conservancy**	EE, FF, JJ, LL MM, WW	Ongoing	M			X	X
	57	**Create a countywide forestry management plan**	X	X	X	X	X	X	X	X		Countywide	**Leelanau Conservation District**	LL	Ongoing	M	X		X	X

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Environment & Natural Resources	58	**Continue efforts to regularly clean up river and lake debris.**				X	X					Countywide	**River & Lake Associations, The Watershed Center Grand Traverse Bay, The Leelanau Conservancy, Leelanau Conservation District, MDNR**	LL, NN, QQ -WW	Ongoing	M			X	X
	59	**Continue to regularly clean out plugged culverts (due to sediment deposits, beaver activity, invasive species, etc.)**	X	X		X	X			X		Countywide	**RC, MDOT, local villages**	OO, PP	As needed	H	X		X	

VIII. Implementation

Hazard mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property from natural and technological hazards. Mitigation is an essential element of emergency management, along with preparedness, response, and recovery. Emergency management includes four phases: actions to mitigate a disaster, a community prepares for a disaster; responds when it occurs; and then there is a transition into the recovery process. The process is cyclical and mitigation measures are evaluated and adopted constantly. The evaluation improves the preparedness posture of the County for the next incident, and so on. When successful, mitigation will lessen the impacts of natural hazards to such a degree that succeeding incidents will remain incidents and not become disasters.

Plan Review, Monitoring, and Evaluation

This Plan is intended to be a resource for building coordination and cooperation within a community for local control of future mitigation and community preparedness. The County Board will lead the implementation of the Natural Hazards Mitigation Plan with assistance from the Emergency Management Coordinator and the Administration. The Local Planning Team (LPT), organized by the County Emergency Management Department, is an inter-agency partnership and will collaborate to accomplish the goals and objectives of the Plan. The LPT meets on a regular basis to carry out its duties and has expanded its role to function as the Natural Hazards Task Force. The Natural Hazards Task Force will be responsible for monitoring and implementing the mitigation plan. Staff support will be provided by the Leelanau County Office of Emergency Management/9-1-1 and will coordinate with the County Board of Commissioners.

Natural Hazards Task Force will perform an annual review of the Leelanau County Hazard Mitigation Plan and consider the list of mitigation strategies identified in the plan. The Task Force will identify projects that have been completed and identify new projects to be completed. The following agencies have been encouraged to actively participate in revising, updating, and maintaining the plan.

- Leelanau County Government Staff
- Townships, cities, and villages
- Leelanau County Conservation District
- Leelanau County Drain Commissioner
- Leelanau County Road Commission
- Grand Traverse Band of Ottawa and Chippewa Indians
- Benzie-Leelanau District Health Department
- Northwest Michigan Invasive Species Network
- Grand Traverse Regional Land Conservancy
- The Watershed Center Grand Traverse Bay
- Networks Northwest
- Michigan State University Extension
- Michigan Department of Environment, Great Lakes, and Energy
- Michigan Department of Natural Resources
- Federal Emergency Management Agency
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- Insurance Companies
- Real Estate Companies

In addition, the townships and villages have indicated to the county emergency manager that they will follow the county's lead in identifying mitigation projects and developing grant applications to fund those projects. Land use issues associated with those projects will be handled by each jurisdiction that have an adopted Master Plan and regulate zoning in the project area.

Community planning and zoning services are provided by the professional staff of each municipality within the county. The respective planners assist communities in developing plans and zoning ordinances, provides resource information and technical assistance, and convenes communities to address land use issues of common interest.

The Leelanau County Building Safety Department completes building and trade inspections for all building projects within the county and issues all building permits. Permits related to water well and septic systems are issued by the Benzie-Leelanau District Health Department. Michigan's Department of EGLE issues permits for proposed land alterations in Critical Dune Areas and High Risk Erosion Areas along the Lake Michigan in Leelanau County.

Plan Integration
The City of Traverse City, all townships and villages in Leelanau County, and local and state agencies will consider integrating information from the hazard mitigation plan into their comprehensive and operations plans. The City of Traverse City and Bingham Township are updating their plans, and they are considering incorporating appropriate hazard mitigation information into the plan. The city, all 11 townships, and the three villages administer zoning. As part of the education and outreach aspect of the hazard mitigation effort, the other townships and villages will be encouraged to adopt zoning regulations to minimize the effect of hazards.

All natural hazards mitigation planning could be pursued using Michigan Public Act 226 of 2003, the Joint Municipal Planning Act. This Act provides for joint land use planning by cities, villages, and townships, and allows two or more municipalities' legislative bodies to create a single joint planning commission to address planning issues. This tool helps with planning for the "big picture" issues such as natural hazards that cross jurisdictional boundaries.

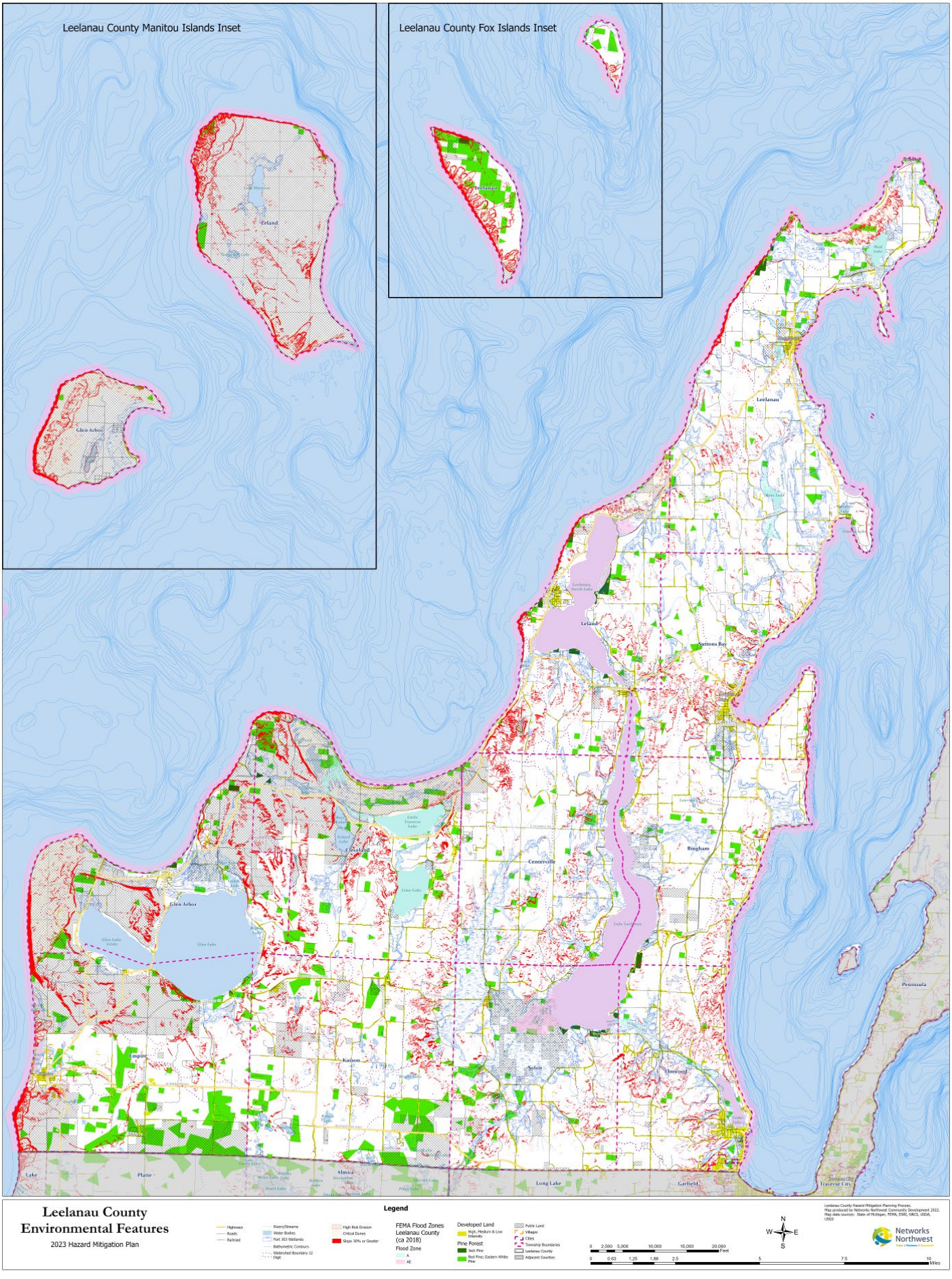
The intent of this legislation is for local governments to consider the following:

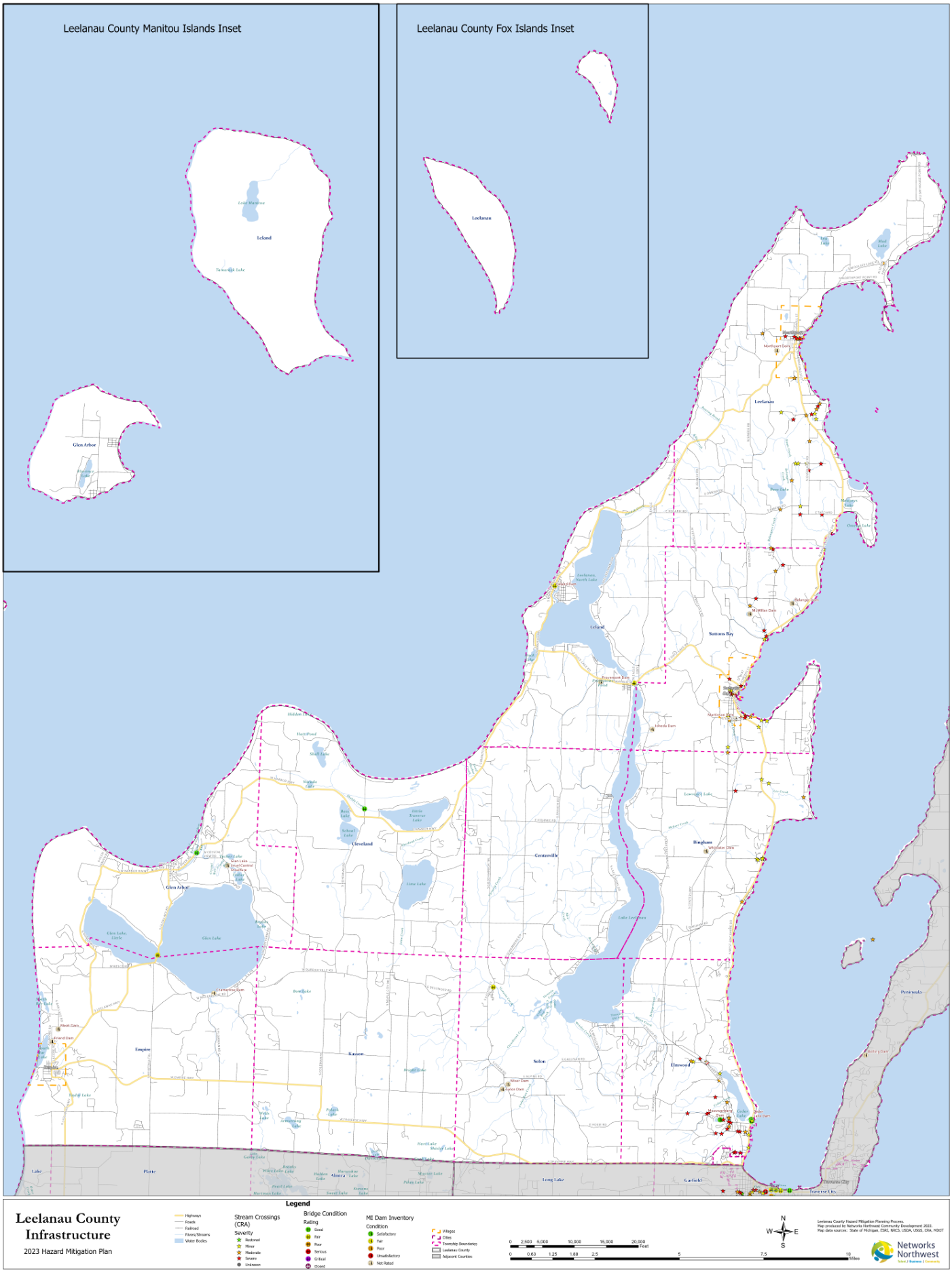
- Individual units of government modifying their ordinances simultaneously to include language that would incorporate aspects of protection
- Developing an overlay zoning district that would cross jurisdictional boundaries which would be incorporated into existing independent units of government's zoning ordinances
- Forming a new joint (multi-jurisdictional) planning commission or zoning board
- Sharing zoning administration and enforcement activities

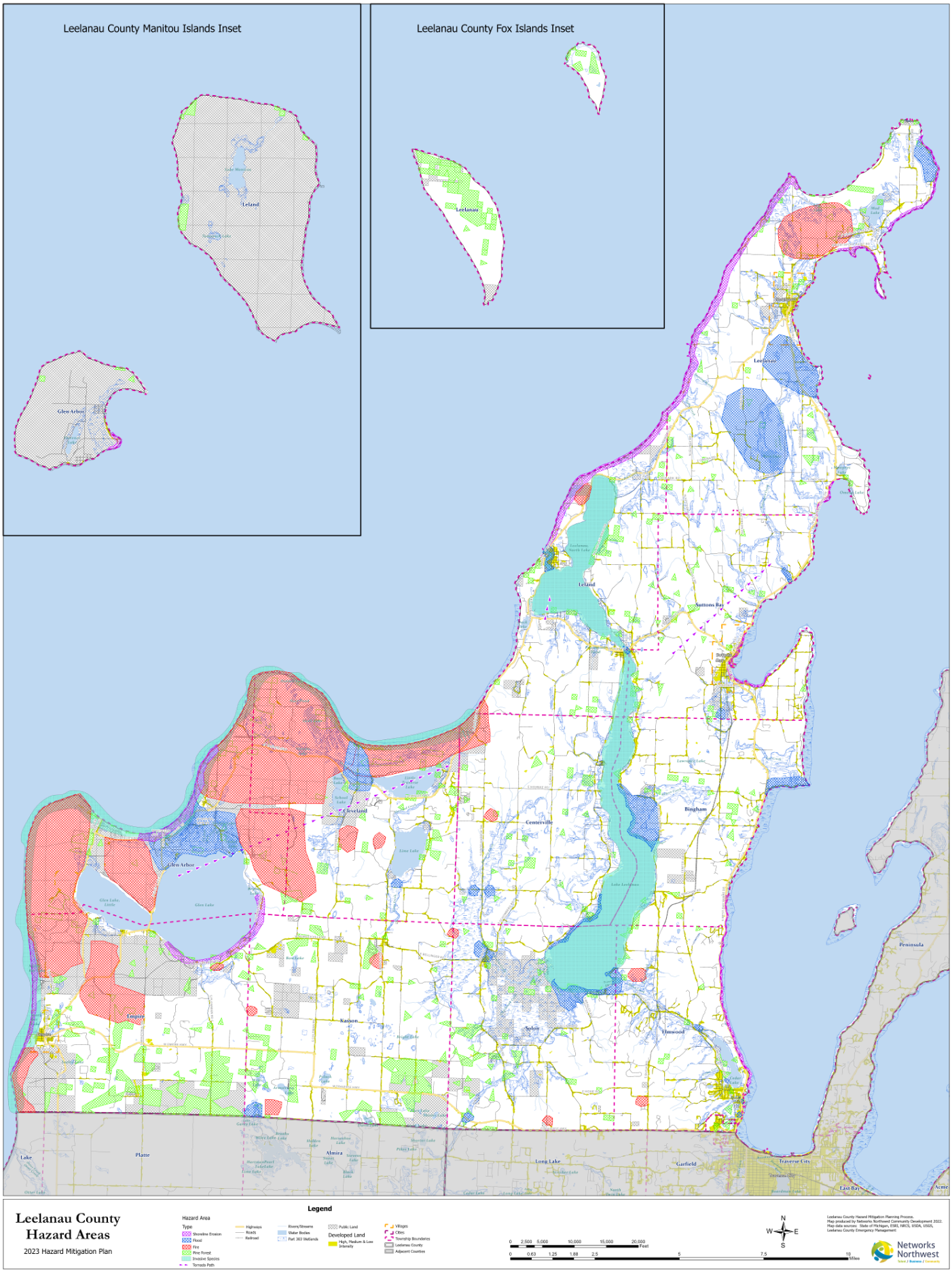
Five Year Plan Review and Update
The Stafford Act, as amended by the Disaster Mitigation Act of 2000, requires the Leelanau County Hazard Mitigation Plan to be updated, adopted, and re-submitted for Federal Emergency Management Agency (FEMA) approval every five years. The plan will be reviewed by the Natural Hazards Task Force every five years in alignment with federal regulations. The update will include determining changes in the county, such as changes in development, an increase in exposure to hazards, an increase or decrease in the communities' capability to address hazards, addition and/or removal of mitigation actions and strategies, reviewing goals, and a change in federal or state legislation. Upon plan review and update completion, the plan will be sent to the State Hazard Mitigation Officer at the Michigan State Police for final review and approval in coordination with FEMA. When the plan has received an "approved pending adoption" status from FEMA, the Leelanau Board of Commissioners can review, approve, and adopt the plan. In order to properly update the plan, Leelanau County will need to seek funding from appropriate state and federal agencies.

Continued Public Involvement
Leelanau County is committed to keeping the public involved in the implementation and update of the Hazard Mitigation Plan. Copies of the plan will be available at the county libraries, county clerk's office, and all township offices, and will be posted on the community websites and/or regional planning agency website. The Emergency Management Office will be responsible for keeping a record of public comments on the plan.

APPENDIX A – Maps


Leelanau County Manitou Islands Inset
Leelanau County Fox Islands Inset
Leelanau
Leland
Glen Arbor
Suttons Bay
Centerville
Cleveland
Bingham
Empire
Kasson
Solon
Elmwood
Peninsula
Lake
Platte
Almira
Long Lake
Garfield
Traverse City
Leelanau County
Environmental Features
2023 Hazard Mitigation Plan
Legend
Highways
Roads
Railroad
Rivers/Streams
Water Bodies
Part 303 Wetlands
Bathymetric Contours
Watershed Boundary 12 Digit
High Risk Erosion
Critical Dunes
Slope 30% or Greater
FEMA Flood Zones
Leelanau County
(ca 2018)
Flood Zone
A
AE
Developed Land
High, Medium & Low Intensity
Pine Forest
Jack Pine
Red Pine, Eastern White Pine
Public Land
Villages
Cities
Township Boundaries
Leelanau County
Adjacent Counties
N
W
E
S
0 2,500 5,000 10,000 15,000 20,000 Feet
0 0.63 1.25 2.5 5 7.5 10 Miles
Networks Northwest

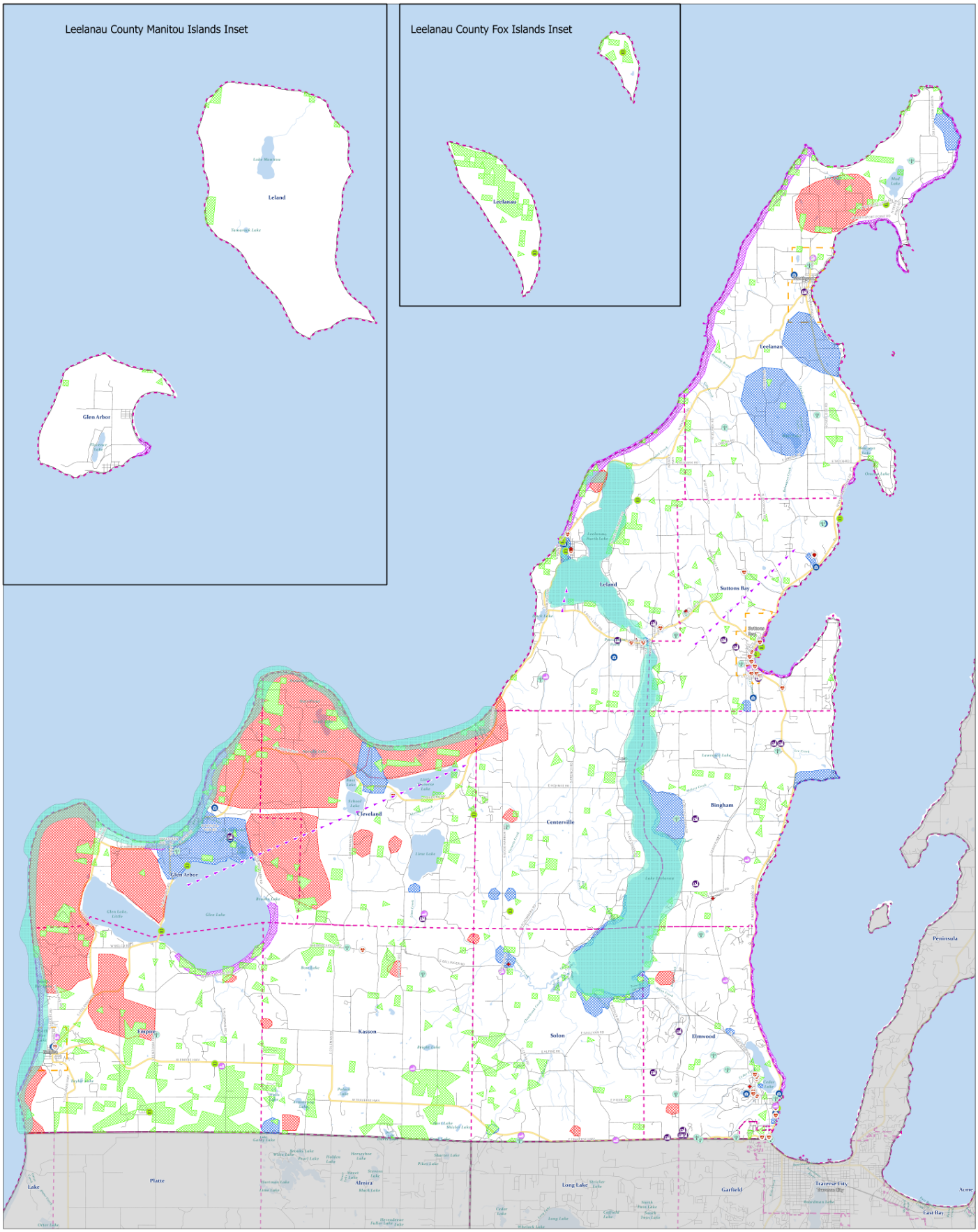

Leelanau County Manitou Islands Inset
Leland
Glen Arbor
Leelanau County Fox Islands Inset
Leelanau
Leelanau
Leland
Suttons Bay
Cleveland
Centerville
Bingham
Glen Arbor
Empire
Kasson
Solon
Elmwood
Peninsula
Garfield
Long Lake
Platte
Lake
Legend
Leelanau County Infrastructure
2023 Hazard Mitigation Plan
Highways
Roads
Railroad
Rivers/Streams
Water Bodies
Stream Crossings (CRA)
Severity
Restored
Minor
Moderate
Severe
Unknown
Bridge Condition
Rating
Good
Fair
Poor
Serious
Critical
Closed
MI Dam Inventory
Condition
Satisfactory
Fair
Poor
Unsatisfactory
Not Rated
Villages
Cities
Township Boundaries
Leelanau County
Adjacent Counties
0 2,500 5,000 10,000 15,000 20,000 Feet
0 0.63 1.25 2.5 5 7.5 10 Miles
N
W
E
S
Leelanau County Hazard Mitigation Planning Process.
Map produced by Networks Northwest Community Development 2022.
Map data sources: State of Michigan, ESRI, NRCS, USDA, USGS, CRA, MDOT
Networks Northwest



Leelanau County Hazard Areas

2023 Hazard Mitigation Plan

Leelanau County Hazard Mitigation Planning Process.
Map produced by Networks Northwest Community Development 2022.
Map data sources: State of Michigan, ESRI, NRCS, USDA, USGS, Leelanau County Emergency Management.



Leelanau County Critical Infrastructure Points & Hazard Areas

2023 Hazard Mitigation Plan

Leelanau County Hazard Mitigation Planning Process
Map produced by Networks Northwest Community Development 2022.
Map data sources: State of Michigan, FEMA, ESRI, NRCS, USDA, USGS

APPENDIX B – Community Survey Results

Q1 Please indicate the organization you represent in Leelanau County.

Answered: 49 Skipped: 0

#	RESPONSES	DATE
1	Grand Traverse Band of Ottawa and Chippewa Indians	1/7/2022 4:34 PM
2	Village of Suttons Bay	11/30/2021 3:43 PM
3	Centerville Township	11/8/2021 11:20 AM
4	Cleveland Township	10/31/2021 2:42 PM
5	Suttons Bay Township	10/29/2021 12:04 PM
6	Benzie Leelanau District Health Department	10/29/2021 10:21 AM
7	Bingham Township	10/28/2021 2:43 PM
8	Village of Empire	10/28/2021 10:57 AM
9	Leelanau County Sheriff's Office	10/27/2021 7:44 AM
10	Benzie-Leelanau District Health Department	10/27/2021 7:37 AM
11	Road Commission	10/26/2021 8:20 PM
12	Suttons Bay Township Planning Commission	10/26/2021 2:04 PM
13	Leland Township Fire & Rescue	10/26/2021 1:50 PM
14	Solon Township Parks	10/26/2021 1:32 PM
15	GTB	10/24/2021 5:11 PM
16	My family and Alcoholics Anonymous	10/22/2021 7:33 PM
17	Grand Traverse Band of Ottawa & Chippewa Indians	10/22/2021 6:18 PM
18	GTB	10/22/2021 6:14 PM
19	Leelanau Sands Casino	10/22/2021 4:09 PM
20	Gtb	10/22/2021 12:55 PM
21	Elder	10/22/2021 12:36 PM
22	Unsure	10/22/2021 12:32 PM
23	KASSON Twp Planning Commission & Kasson Twp Boaed of Review	10/21/2021 1:01 PM
24	Department of Building Safety	10/20/2021 10:26 AM
25	Traverse City Fire Department	10/19/2021 4:28 PM
26	Leland Public School	10/19/2021 3:51 PM
27	Heartland-ProMedica Hospice	10/19/2021 2:59 PM
28	Leelanau County Emergency Management/911	10/19/2021 1:39 PM
29	Leelanau County Office of Emergency Management/9-1-1	10/19/2021 1:28 PM
30	Michigan State Police	10/19/2021 1:00 PM
31	American Red Cross of Northern Michigan	10/19/2021 12:36 PM
32	Grand Traverse Band of Ottawa and Chippewa Indians Tribal Liaison.	10/19/2021 12:29 PM
33	Leelanau Conservancy	10/19/2021 12:13 PM

34	Leelanau County Road Commission	10/12/2021 10:09 AM
35	Road Commissioner	10/10/2021 6:59 AM
36	Kasson Township	10/7/2021 5:21 PM
37	Village of Empire	10/6/2021 12:52 PM
38	Village of Empire	10/6/2021 9:33 AM
39	Centerville Township Planning Commission	10/6/2021 5:59 AM
40	Solon Township Board	10/5/2021 12:55 PM
41	Centerville Township	10/5/2021 11:29 AM
42	Northport Village Planning Commission	10/4/2021 4:21 PM
43	Suttons Bay Township	10/4/2021 1:21 PM
44	I am the Suttons Bay Township Treasurer	10/4/2021 1:17 PM
45	Glen Arbor Township	10/4/2021 11:42 AM
46	LEELANAU COUNTY ROAD COMMISSION	10/4/2021 10:54 AM
47	Charter Township of Elmwood	10/4/2021 10:35 AM
48	Planning	10/4/2021 10:17 AM
49	Suttons Bay Township Board	10/4/2021 10:07 AM

Q2 What is your role in this organization?

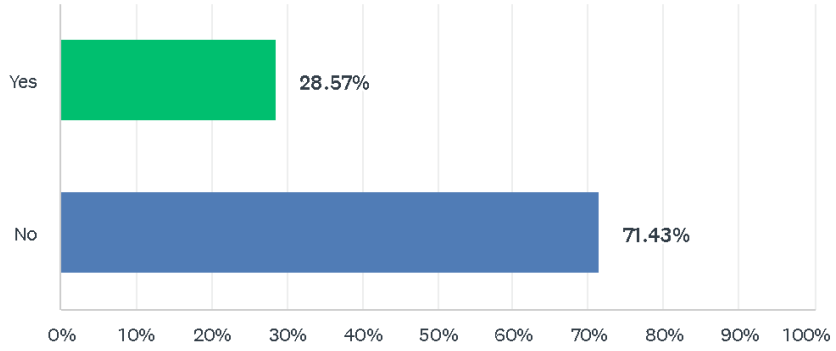
Answered: 49 Skipped: 0

#	RESPONSES	DATE
1	Tribal member living and working on the reservation (GTB Administration)	1/7/2022 4:34 PM
2	Clerk	11/30/2021 3:43 PM
3	Supervisor	11/8/2021 11:20 AM
4	Clerk	10/31/2021 2:42 PM
5	Supervisor	10/29/2021 12:04 PM
6	Emergency Preparedness Coordinatory	10/29/2021 10:21 AM
7	Supervisor	10/28/2021 2:43 PM
8	Clerk	10/28/2021 10:57 AM
9	Undersheriff	10/27/2021 7:44 AM
10	Director of Personal Health	10/27/2021 7:37 AM
11	Commissioner	10/26/2021 8:20 PM
12	Commission member	10/26/2021 2:04 PM
13	Fire Chief	10/26/2021 1:50 PM
14	Committee Chair	10/26/2021 1:32 PM
15	Member	10/24/2021 5:11 PM
16	I chair a meeting in Traverse City for women	10/22/2021 7:33 PM
17	Clinical Social Worker/Program Director	10/22/2021 6:18 PM
18	Tribal Member	10/22/2021 6:14 PM
19	Employee	10/22/2021 4:09 PM
20	Member	10/22/2021 12:55 PM
21	retired	10/22/2021 12:36 PM
22	Unsure	10/22/2021 12:32 PM
23	Secretary and Chairman, respectively	10/21/2021 1:01 PM
24	Building Official (head of the department)	10/20/2021 10:26 AM
25	Fire Chief	10/19/2021 4:28 PM
26	Superintendent	10/19/2021 3:51 PM
27	Administrator	10/19/2021 2:59 PM
28	Deputy Director	10/19/2021 1:39 PM
29	Director	10/19/2021 1:28 PM
30	Assistant Post Commander	10/19/2021 1:00 PM
31	Disaster Program Manager	10/19/2021 12:36 PM
32	Tribal Emergency Manager and County LPT Tribal Liaison.	10/19/2021 12:29 PM
33	Fund Raising	10/19/2021 12:13 PM

34	Managing Director	10/12/2021 10:09 AM
35	Road Commisioner	10/10/2021 6:59 AM
36	Township Clerk	10/7/2021 5:21 PM
37	Trustee	10/6/2021 12:52 PM
38	Trustee	10/6/2021 9:33 AM
39	PC member	10/6/2021 5:59 AM
40	Trustee	10/5/2021 12:55 PM
41	Planning Commission Chair	10/5/2021 11:29 AM
42	Commissioner	10/4/2021 4:21 PM
43	Zoning Administrator	10/4/2021 1:21 PM
44	Treasurer	10/4/2021 1:17 PM
45	Elected Township Supervisor	10/4/2021 11:42 AM
46	FLEET AND FACILITIES MANAGER	10/4/2021 10:54 AM
47	Supervisor	10/4/2021 10:35 AM
48	Planning Director	10/4/2021 10:17 AM
49	Trustee	10/4/2021 10:07 AM

Q3 Are you familiar with the county's Natural Hazard Mitigation Plan?

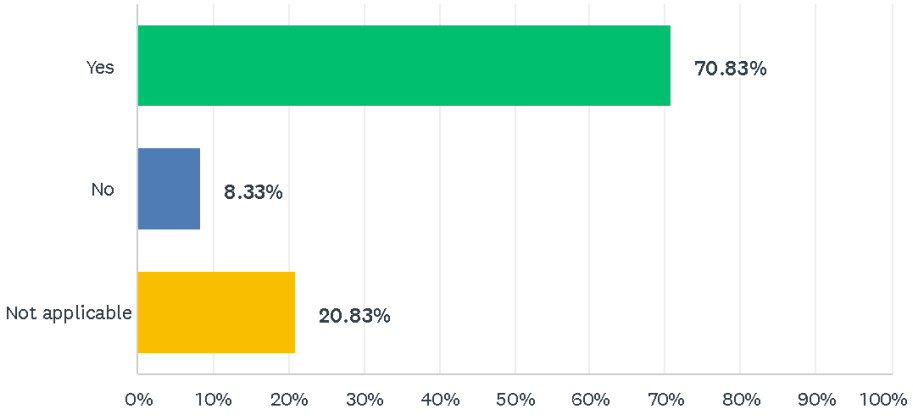
Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	28.57%	14
No	71.43%	35
TOTAL		49

Q4 Does the community you represent have an adopted Master Plan?

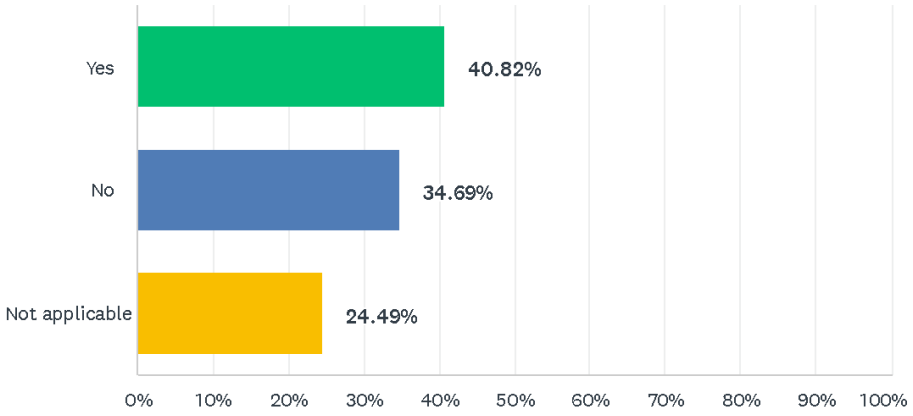
Answered: 48 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	70.83%	34
No	8.33%	4
Not applicable	20.83%	10
TOTAL		48

Q5 Does the community you represent have an adopted Capital Improvements Plan?

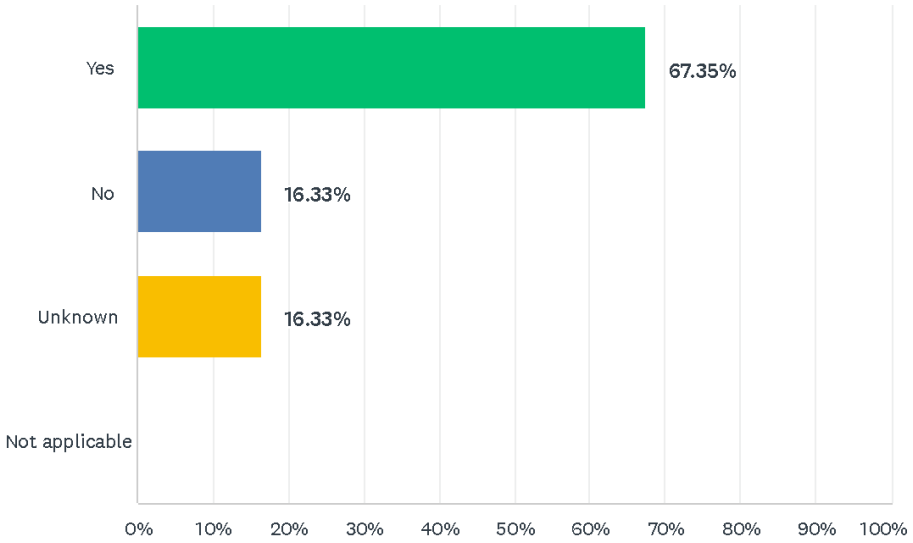
Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	40.82%	20
No	34.69%	17
Not applicable	24.49%	12
TOTAL		49

Q6 Has the community you represent experienced a significant natural hazard event within the last 10 years?

Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	67.35%	33
No	16.33%	8
Unknown	16.33%	8
Not applicable	0.00%	0
TOTAL		49

Q7 If so, what was the nature of the event?

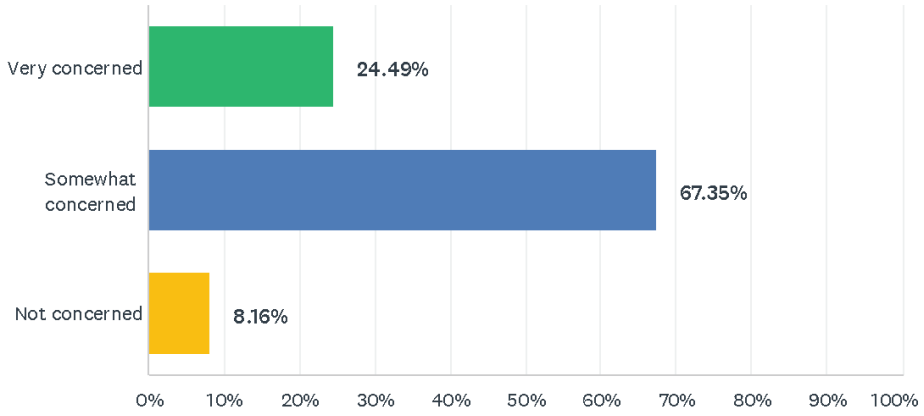
Answered: 36 Skipped: 13

#	RESPONSES	DATE
1	August 2016 straight line wind damages, multiple extended power outages over the past 10 years, and the COVID-19 pandemic since 2020.	1/7/2022 4:34 PM
2	COVID	11/8/2021 11:20 AM
3	Straight line wind event	10/29/2021 10:21 AM
4	Erosion of bluff to within eight inches of Lee Point. The township participated financially in emergency repair to erosion area to shore up road. Winter storm out of south forcing high waves to erode bluff. Road Flooding on Lee Point Road due to 6.5" on one occasion this year.	10/28/2021 2:43 PM
5	Lakeshore erosion undermining adjacent infrastructure	10/28/2021 10:57 AM
6	Straight line wind event, Flooding	10/27/2021 7:44 AM
7	Pandemic	10/27/2021 7:37 AM
8	Large windstorm	10/26/2021 8:20 PM
9	Earthen dam failure at Vlacks park. Regular flooding in Cedar.	10/26/2021 1:32 PM
10	Unknown	10/24/2021 5:11 PM
11	Snowstorm and we went without electricity for a while	10/22/2021 7:33 PM
12	COVID 19	10/22/2021 6:18 PM
13	N/A	10/22/2021 6:14 PM
14	Snow storm	10/22/2021 12:55 PM
15	na	10/22/2021 12:36 PM
16	Severe storm in 2015	10/20/2021 10:26 AM
17	Straight line winds August 2017	10/19/2021 4:28 PM
18	A pandemic.	10/19/2021 3:51 PM
19	Winter storm event, COVID 19 pandemic	10/19/2021 2:59 PM
20	Severe storm/straight line winds	10/19/2021 1:39 PM
21	August 2, 2015 - Straight-line wind event which lead to a Governor's Disaster Declaration	10/19/2021 1:28 PM
22	Flooding, Wind Event, Ice Storms, Wild fires	10/19/2021 12:36 PM
23	2012 Winter Storm in Leelanau County; August 2018 Summer Straight Line Wind event.	10/19/2021 12:29 PM
24	Straight Line Storm in 2015	10/19/2021 12:13 PM
25	Straight-line wind storm	10/12/2021 10:09 AM
26	Large windstorm	10/10/2021 6:59 AM
27	Our beach was torn apart by high water and wind activity.	10/6/2021 12:52 PM
28	High Water on our beach which also affects high water table in the Village.	10/6/2021 9:33 AM
29	High wind event in summer 2016 (I think). Glen Arbor heavily impacted and unsure direct impact to Centerville (perhaps none)	10/6/2021 5:59 AM
30	2015 storm that brought "straight line" winds that acted like a tornado taking out hundreds of trees and caused power losses that lasted several days.	10/5/2021 11:29 AM

31	Erosion along the lake shore	10/4/2021 1:17 PM
32	Straight Wind Damage	10/4/2021 11:42 AM
33	STRAIGHT LINE WINDS	10/4/2021 10:54 AM
34	Straight line wind storm, August 2, 2017. Flooding 2020.	10/4/2021 10:35 AM
35	August 2015 - straight wind storm March 2012 - snow storm	10/4/2021 10:17 AM
36	Shoreline Erosion due to rising water levels Covid Pandemic	10/4/2021 10:07 AM

Q8 How concerned are you about future natural hazard events impacting your community?

Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very concerned	24.49%	12
Somewhat concerned	67.35%	33
Not concerned	8.16%	4
TOTAL		49

Q9 What type of natural hazard events are likely to have the largest impact on your community, for example fire, flood, drought, illness outbreak, etc.?

Answered: 48 Skipped: 1

#	RESPONSES	DATE
1	The COVID-19 illness outbreak has had the most significant impact on our community, government and businesses as a whole.	1/7/2022 4:34 PM
2	Fire, flood, illness outbreak	11/30/2021 3:43 PM
3	Another pandemic, high winds	11/8/2021 11:20 AM
4	Flood	10/31/2021 2:42 PM
5	Flooding from unusual rain events, high wind event, sustained high Lake Michigan water level	10/29/2021 12:04 PM
6	Illness outbreak, fire, flood	10/29/2021 10:21 AM
7	Possibly illness outbreak and flood.	10/28/2021 2:43 PM
8	Flood, high winds, high water levels impacting both Lake MI shoreline and inland waters adjacent to homes	10/28/2021 10:57 AM
9	Wind Storm, Panademic	10/27/2021 7:44 AM
10	Continued pandemic, severe weather (e.g blizzard with extended power outages and impassable roads)	10/27/2021 7:37 AM
11	Ice storm	10/26/2021 8:20 PM
12	illness, snow, power outages	10/26/2021 2:04 PM
13	Wildfire, Utility Outages, Lakeshore erosions, Tornado/Severe Weather	10/26/2021 1:50 PM
14	Fire, flooding,storm damage blocking roads, civil unrest. (The last is not a natural disaster, but neither is illness outbreak)	10/26/2021 1:32 PM
15	Flooding and outbreak	10/24/2021 5:11 PM
16	This Coronavirus	10/22/2021 7:33 PM
17	Fire, flood and especially more illness - Delta Plus is impacting England now.	10/22/2021 6:18 PM
18	Illness	10/22/2021 6:14 PM
19	Flood, illness outbreak	10/22/2021 4:09 PM
20	Snow Storm	10/22/2021 12:55 PM
21	fire	10/22/2021 12:36 PM
22	Fire and/or illness outbreak	10/22/2021 12:32 PM
23	Tornado, wild fire, drought (in that order)	10/21/2021 1:01 PM
24	Flooding, storms	10/20/2021 10:26 AM
25	Ice storm, straight line winds, protracted winter storm.	10/19/2021 4:28 PM
26	Fire and illness outbreak	10/19/2021 3:51 PM
27	Global pandemic (COVID-19), winter storm, flood	10/19/2021 2:59 PM
28	Severe weather	10/19/2021 1:39 PM
29	Extreme weather event (wind, tornado, ice storm, blizzards, etc.), Long-term power outage, flooding, drought, agricultural disease	10/19/2021 1:28 PM

30	Hazardous weather, fires and floods.	10/19/2021 1:00 PM
31	Fire, Flood, outbreak	10/19/2021 12:36 PM
32	Winter storms and high wind events and pandemics.	10/19/2021 12:29 PM
33	Wind storms and blizzards and invasive specie invasions	10/19/2021 12:13 PM
34	wind storm and flood	10/12/2021 10:09 AM
35	Blizzard, ice storm, flooding, lack of utilities	10/10/2021 6:59 AM
36	Fire, wind, ice, snow	10/7/2021 5:21 PM
37	High water levels and wind	10/6/2021 12:52 PM
38	High Water	10/6/2021 9:33 AM
39	Clearly illness outbreak and local health system capacity is something we need to think about in the context of the pandemic. Beyond that, I am very concerned about what heavy flooding and/or forest fires would do to our county and how we might respond.	10/6/2021 5:59 AM
40	Flood	10/5/2021 12:55 PM
41	Fire, tornado, large snow events, heavy rains causing flooding in low areas, extended power losses from the aforementioned and pandemics.	10/5/2021 11:29 AM
42	Windstorm, illness	10/4/2021 4:21 PM
43	High Great Lakes Water Levels	10/4/2021 1:21 PM
44	Fire	10/4/2021 11:42 AM
45	FLOOD, WIND, FIRE	10/4/2021 10:54 AM
46	Flooding	10/4/2021 10:35 AM
47	Snow storm, ice storm, wind, illness outbreak	10/4/2021 10:17 AM
48	Flooding, illness	10/4/2021 10:07 AM

Q10 Does your community have concerns about infrastructure (dams, bridges, utilities, etc.) and the potential for a hazardous event in the future? Please describe.

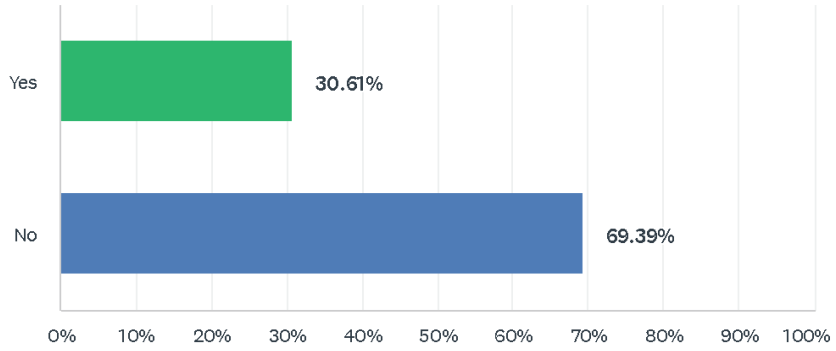
Answered: 44 Skipped: 5

#	RESPONSES	DATE
1	Yes - please refer to the GTB Natural Hazard Mitigation Plan.	1/7/2022 4:34 PM
2	Roads, water and sewer	11/30/2021 3:43 PM
3	Not specifically	11/8/2021 11:20 AM
4	Road edge drains and culverts, interior ditching, insufficient for anticipated future water handling	10/29/2021 12:04 PM
5	High waters create a concern for erosion and flooding of roads along the shorelines and creeks.	10/28/2021 2:43 PM
6	Yes. There is currently a drainage district being considering by County Drain Commissioner including an inland lake outlet that under a road. Shoreline erosion could undermine a paved parking lot.	10/28/2021 10:57 AM
7	Not Sure	10/27/2021 7:44 AM
8	Unsure	10/27/2021 7:37 AM
9	Possibly ice storm. Our county is isolated and has only few transmissions lines and roads entering from the south only.	10/26/2021 8:20 PM
10	Yes, dams and bridges potentially. Utility outages are a concern too.	10/26/2021 1:50 PM
11	Yes, the road bridge over the cedar river is too small and is not in good repair.	10/26/2021 1:32 PM
12	They seem to be moving forward with to repair and improve any needed concerns	10/24/2021 5:11 PM
13	When we have a power outage we can't even use the stove	10/22/2021 7:33 PM
14	Utilities, roads and bridges would be severely affected by weather events, especially as climate change is warming northern Michigan, especially the last 10 to 15 years.	10/22/2021 6:18 PM
15	Not at this time	10/22/2021 6:14 PM
16	Not that I'm aware	10/22/2021 4:09 PM
17	Yes Electric Roads	10/22/2021 12:55 PM
18	no	10/22/2021 12:36 PM
19	Yes but no changes have been made	10/22/2021 12:32 PM
20	No	10/21/2021 1:01 PM
21	Unknown	10/20/2021 10:26 AM
22	Union Street dam in Traverse City. Taking steps now to monitor for planned replacement in near future.	10/19/2021 4:28 PM
23	Not really. We just completed an extensive construction project and upgraded our fire suppression system, electrical system, water holding and septic systems, and all HVAC/Mechanical systems.	10/19/2021 3:51 PM
24	Yes	10/19/2021 2:59 PM
25	Not to my knowledge	10/19/2021 1:39 PM

26	Utility infrastructure during long-term outage; Glen Arbor power grid had to be rebuilt after August 2nd Storm, 7-10 days without power in middle of summer, many concerns for that to recur. Dams & bridges do not pose threat to loss of life, very minimal at best. Would create an inconvenience for transportation via temporary detours. If erosion or high water threatened erosion that impacted M-22 (circles the County), that infrastructure would have a lasting impact.	10/19/2021 1:28 PM
27	Waterway structures	10/19/2021 1:00 PM
28	unknown	10/19/2021 12:36 PM
29	Erosion and flood and dams/bridges in county for direct routes impacts and structural damage.	10/19/2021 12:29 PM
30	Yes.	10/19/2021 12:13 PM
31	Flooding has to potential to washout roads, especially at creek crossings that become overwhelmed	10/12/2021 10:09 AM
32	washouts, road blockage, downed powerlines, flooding	10/10/2021 6:59 AM
33	Yes. Utilities are frequently damaged by even fairly minor wind and ice events. Fire in the wildland urban interface is an increasing hazard.	10/7/2021 5:21 PM
34	We have several areas on our public beach that are not reinforced and could be lost when future high water and wind events occur.	10/6/2021 12:52 PM
35	I have concerns on two fronts. Our public beach facilities were under siege with the high water in 2018/2019 (as were all of our Lake Michigan coast cities and villages. We must be better prepared to cope with those events. In addition, I have concerns about our ability to manage storm water drainage issues.	10/6/2021 9:33 AM
36	Not that I am aware of in our township	10/6/2021 5:59 AM
37	Certainly infrastructure	10/5/2021 12:55 PM
38	No damns or bridges in our Township. Power outages are a concern.	10/5/2021 11:29 AM
39	No dams, few bridges. Primary concern are electric utilities and roadways.	10/4/2021 4:21 PM
40	no	10/4/2021 11:42 AM
41	NOT AT THIS TIME	10/4/2021 10:54 AM
42	no	10/4/2021 10:35 AM
43	not sure	10/4/2021 10:17 AM
44	Culverts are old and failing causing unnecessary erosion and changes in rivers path	10/4/2021 10:07 AM

Q11 Have you been involved in a natural hazard mitigation planning process before?

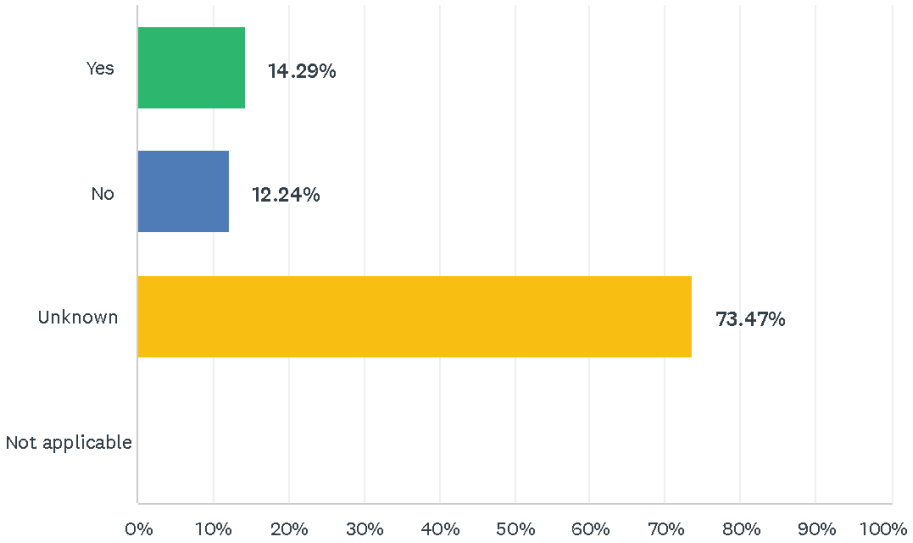
Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	30.61%	15
No	69.39%	34
TOTAL		49

Q12 Has your community requested assistance for mitigation projects in the past?

Answered: 49 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	14.29%	7
No	12.24%	6
Unknown	73.47%	36
Not applicable	0.00%	0
TOTAL		49

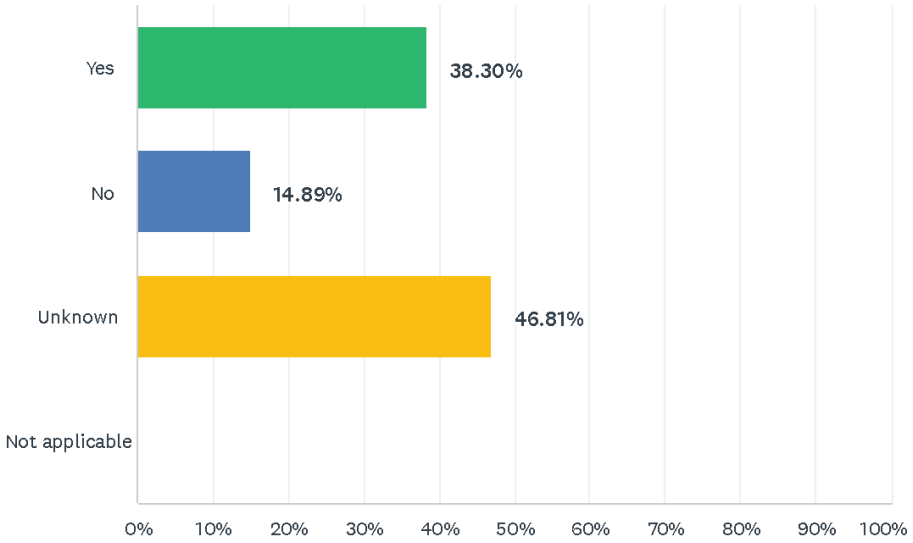
Q13 If so, was your request granted and what type of project did the request include?

Answered: 25 Skipped: 24

#	RESPONSES	DATE
1	Can't remember the details.	1/7/2022 4:34 PM
2	not sure	10/26/2021 8:20 PM
3	n/a	10/26/2021 1:50 PM
4	Unknown	10/24/2021 5:11 PM
5	None	10/22/2021 7:33 PM
6	Unknown	10/22/2021 6:14 PM
7	Not sure	10/22/2021 12:55 PM
8	na	10/22/2021 12:36 PM
9	Unknown	10/20/2021 10:26 AM
10	Assistance from outside agencies in determining risk.	10/19/2021 4:28 PM
11	unknown	10/19/2021 2:59 PM
12	N/A	10/19/2021 1:39 PM
13	N/A	10/19/2021 1:28 PM
14	provide shelter list	10/19/2021 12:36 PM
15	Natural hazards projects.	10/19/2021 12:29 PM
16	Yes...coordination with law enforcement	10/10/2021 6:59 AM
17	Unknown.	10/7/2021 5:21 PM
18	We received a grant, however, the Village Council voted to not accept the grant. The grant would have rebuilt our boat launch and reinforced the infrastructure in front of our lighthouse.	10/6/2021 12:52 PM
19	Unknown	10/6/2021 5:59 AM
20	No it wasn't granted, it was to expand the Cedar Community Park and make it more user friendly.	10/5/2021 12:55 PM
21	Unknown	10/4/2021 4:21 PM
22	UNKNOWN	10/4/2021 10:54 AM
23	n/a	10/4/2021 10:35 AM
24	N/A	10/4/2021 10:17 AM
25	Costs were shared with other county entities to help remove Phragmites on shorelines and inland areas Costs were shared with the County Road Commission and Village to add shoreline protection rocks to South Shore Drive in Suttons Bay	10/4/2021 10:07 AM

Q14 Has your community considered mitigation strategies for potential or current hazards?

Answered: 47 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	38.30%	18
No	14.89%	7
Unknown	46.81%	22
Not applicable	0.00%	0
TOTAL		47

Q15 If so, please identify potential strategies you would like to explore in the near future.

Answered: 26 Skipped: 23

#	RESPONSES	DATE
1	We lack facilities to provide extended large scale medication distribution or medical care	10/27/2021 7:37 AM
2	not sure	10/26/2021 8:20 PM
3	n/a	10/26/2021 1:50 PM
4	Unknown	10/24/2021 5:11 PM
5	We need to find out about our waterways	10/22/2021 7:33 PM
6	Increased access to the rural area with respect to high speed internet as this has impacted students and families with the current COVID19 pandemic. This is a very rural county and lack of internet has affected families and students ability to work and learn from home.	10/22/2021 6:18 PM
7	Climate change & weather related strategies	10/22/2021 6:14 PM
8	Generators Snow Removal Equipment	10/22/2021 12:55 PM
9	unknown	10/22/2021 12:36 PM
10	Unknown	10/20/2021 10:26 AM
11	Protection of above-ground electric service grid. Protection of stream and river banks. Protection of infrastructure and property affected by high water levels adjacent tot he Great Lakes	10/19/2021 4:28 PM
12	We have a state required emergency operations plan that addresses all manner of natural and other emergencies.	10/19/2021 3:51 PM
13	unknown	10/19/2021 2:59 PM
14	Need to look at drainage issues/flooding issues in the Elmwood Twp. area.	10/19/2021 1:39 PM
15	Shoreline erosion from high water levels concerned villages and marinas. Shoreline wrap or stone seawall applications would be considered. Also raising marina docks would be necessary.	10/19/2021 1:28 PM
16	Infrastructure and reduction of weather hazards and support to utilities.	10/19/2021 12:29 PM
17	How to mitigate flooding that comes from outside the right of way, where we have little or no control	10/12/2021 10:09 AM
18	lists, plans, proper equipment	10/10/2021 6:59 AM
19	I would like to hear ideas that will help us plan to safeguard our beach infrastructure without causing damage to properties that surround our public beach.	10/6/2021 12:52 PM
20	We have, as a council, very briefly discussed coastal resilience management grants - but have not gone further. We have, also, very informally discussed some of our storm water drainage issues with our village engineer, but we have not taken any formal action on either.	10/6/2021 9:33 AM
21	unknown	10/6/2021 5:59 AM
22	Improving the Cedar Community Park area. Also install a Cedar Community Septic System.	10/5/2021 12:55 PM
23	Unknown	10/4/2021 4:21 PM
24	COMMUNICATION AND PROPER DISPATCH SCHEDULE	10/4/2021 10:54 AM
25	n/a	10/4/2021 10:35 AM

26	N/A	10/4/2021 10:17 AM

Q16 Is there any additional information you would like us to consider as we update the county's Natural Hazard Mitigation Plan?

Answered: 28 Skipped: 21

#	RESPONSES	DATE
1	I was a grant writer in the past and that was the extent of my involvement in assisting with the submission of past hazardous mitigation plans.	1/7/2022 4:34 PM
2	Not at this time	11/8/2021 11:20 AM
3	Climate Change is increasing all risks. Past history is not a good indicator for what we'll face	10/29/2021 12:04 PM
4	Individuals that are home bound due to health issues. Individuals that lack access to transportation	10/29/2021 10:21 AM
5	Consider ice storms.	10/26/2021 8:20 PM
6	not that I can think of.	10/26/2021 1:50 PM
7	Solon Township needs to be included and also needs a workshop with the board to identify our community needs and go through thos process.	10/26/2021 1:32 PM
8	Not at this time	10/24/2021 5:11 PM
9	None	10/22/2021 7:33 PM
10	Power outages during storms continue to be an issue in the county and we have many elders and retirees, it can be dangerous in the winter months. This should be considered.	10/22/2021 6:14 PM
11	Not at this time	10/22/2021 12:55 PM
12	unknown	10/22/2021 12:36 PM
13	No	10/21/2021 1:01 PM
14	No	10/20/2021 10:26 AM
15	Not at this time.	10/19/2021 4:28 PM
16	not at this time	10/19/2021 2:59 PM
17	No	10/19/2021 1:28 PM
18	Sustainment of infrastructure, utilities due to power outages and addressing erosion.	10/19/2021 12:29 PM
19	Better cell coverage and communication towers are a must. I'm not sure that all areas of this County could be alerted fast enough if a disaster was to happen	10/19/2021 12:13 PM
20	participation in any planning	10/10/2021 6:59 AM
21	Forest fires, drought, and heavy wind/extreme weather events are the most critical in my opinion	10/6/2021 5:59 AM
22	Look for funds that can be used to put in a Community Septic system in Cedar.	10/5/2021 12:55 PM
23	Keep up the good work.	10/5/2021 11:29 AM
24	Electric utility infrastructure, communication issues during outages, up to date accurate pandemic information.	10/4/2021 4:21 PM
25	NOT AT THIS TIME	10/4/2021 10:54 AM
26	no	10/4/2021 10:35 AM
27	N/A	10/4/2021 10:17 AM

28	Please to learn this activity is beginning	10/4/2021 10:07 AM

APPENDIX C – Current Status of 2016 Hazard Mitigation Plan Strategies

2016 Leelanau County Natural Hazard Mitigation Plan Strategies and 2023 Status

Priority Areas and Mitigation Strategies	Responsible Parties	Timeframe	2023 Status/ EM Comments	Related Strategies in the 2023 Plan and Priority Level
Priority Area 1: Extreme Winter Weather – countywide heavy snow, extreme temperatures and concerns regarding power and agricultural loss. Snow Load Mitigation Strategies.				
a. Snow load design standards – develop planning grant for a study of snowfall patterns and occurrence of damage	County Planning Department Emergency Management Coordinator County Building Official	1-3 years from adoption of the plan	This strategy is no longer included as a feasible or necessary strategy in the 2023 plan	A related strategy would be #25 in the new plan, which is to "review zoning and building codes to improve structural resilience to hazards." (High priority)
b. Public education and awareness	County Building Official County Planning Department Emergency Management Coordinator Townships, Villages, City	1-3 years from adoption of the plan	NWS Weather messages are relayed to community members by the RAVE Alert mass notification system	#3a (Medium), 3d (High)
c. Enforcement of building codes for new construction	County Building Official	Ongoing	Building Safety currently enforces updated construction codes	#26 (Medium)
Priority Area 2: Severe Weather (High Winds and Tornadoes) – countywide highlighting seasonal population influx and local festivals. High Winds and Tornado Mitigation Strategies				
a. Develop and implement mutual support and aid practices with surrounding communities	County Planning Emergency Management Coordinator County Building Official Townships, Villages, City	1-3 years from adoption of the plan	Emergency Services Agencies have current Mutual Aid Agreements in place. Fire & EMS part of MI Mutual Aid Box Alarm System (MABAS)	#2 (High), #3 (Medium)
b. Tree management by power companies on power line easements	Emergency Management Coordinator County Building Official	Ongoing	Utilities continue to perform emergency and preventative tree work	#42 (High), #43 (Medium) #44-45 (High)
c. Public education	County Building Official County Planning Emergency Management Coordinator Townships, Villages	1-3 years from adoption of the plan	Messaging via social media and community outreach programs supported for Severe Weather Awareness Weeks	#3a – 3c (Medium), #3d (High), #23a (Medium), #29 (Medium)
d. Suggest that events have an evacuation/response plan	County Planning Emergency Management Coordinator	1-3 years from adoption of the plan	Most communities require events to cooperate with EM to establish Incident Action Plans for events	#7 (Medium)
e. Building Code enforcement for new construction	County Building Official	Ongoing	Building Safety enforces updated building codes	#26 (Medium)

2016 Leelanau County Natural Hazard Mitigation Plan Strategies and 2023 Status

Priority Areas and Mitigation Strategies	Responsible Parties	Timeframe	2023 Status/ EM Comments	Related Strategies in the 2023 Plan and Priority Level
Priority Area 3: Erosion affecting slopes and bluffs near Lake MI communities; and wetland loss countywide. Erosion and Debris Flow Mitigation Strategies.				
a. Inventory of shoreline erosion sites	County Planning Emergency Management Coordinator Drain Commissioner County Soil Conservation District	1-3 years from adoption of the plan	2019-2020 high water marks caused public & private response measures for mitigation. MDOT has taken responsibility along state highways, local municipalities have assessed their own needs, inquiring land owners have been directed to County Conservation District and private businesses for mitigation measures.	#54 (High)
b. More detailed soil erosion permits – slide areas, drainage control, grading, debris flow measures, vegetation (native species) placement	County Soil Conservation District Emergency Management Coordinator MI Department of Environmental Quality	Ongoing	The Leelanau County Conservation District and the Soil Erosion & Sediment Control Inspector/ Drain Commissioner are working to create additional drainage districts	#27 (High)
c. Zoning administration and enforcement of ordinances/permits	County Planning County Building Official Emergency Management Coordinator Drain Commissioner County Soil Conservation District MI Department of Environmental Quality U.S. Army Corps of Engineers	Ongoing	The County Conservation District expanded their role for permitting after 2019 high water levels. Increased demand resulted in an expedited process to issue permits for remediation and mitigation measures.	#25 (High), #27 (High) #28 (High)
d. Open space designations: acquisition or conservation easements by land conservancies, county, townships	County Planning Townships, Villages Land Conservancies	1-5 years from adoption of the plan	The Leelanau Conservancy has acquired land parcels for open space designation. Acquisition of land in Leland and Solon Townships afforded expansion of existing public areas (Leland) and establishment of new public areas (Solon).	#54 (High), #55 (Medium)
e. Public education	County Planning Emergency Management Coordinator County Soil Conservation District Drain Commissioner Townships, Villages	1-3 year from adoption of the plan	The Army Corps of Engineers outreach messaging provided to public and targeted areas via email upon request.	#3 (Medium), 3d (High), #56 (Medium)
f. Building code enforcement through permits	County Building Official	Ongoing	Building Safety works with Soil & Conservation for Permitting	#26 (Medium)

2016 Leelanau County Natural Hazard Mitigation Plan Strategies and 2023 Status

Priority Areas and Mitigation Strategies	Responsible Parties	Timeframe	2023 Status/ EM Comments	Related Strategies in the 2023 Plan and Priority Level
Priority Area 4: Dam and bridge failure and localized flooding (further affected by elevated water levels in Lake MI and inland lakes; countywide. Flood Mitigation Strategies.				
a. Assessment of flood threat and dam inspections results	Emergency Management Coordinator County Planning Drain Commissioner	1-3 years from adoption of the plan	Major dams in County have Emergency Response Plan in place, reviewed consistently by EGLE	#39 and 40 (Medium)
b. Research a flood warning system	Emergency Management Coordinator	1-3 years from adoption of the plan	NWS provides flood advisories, RAVE Alert mass notification system and IPAWS and/or WEA alerts are available for serious events	This strategy is no longer needed/included in the 2023 plan.
c. Public education	Emergency Management Coordinator County Planning Drain Commissioner County Soil Conservation District Townships, Villages	Ongoing	NWS outreach messaging provided to public and areas of concern via email.	#3 and 3a (Medium); 3d (High)
d. Building code enforcement		Ongoing	Building Safety enforces measures for flood prevention	#25 (High); #26 (Medium)

Priority Area 5: Potential wildfire/urban interface – countywide. Wildfire Mitigation Strategies				
a. Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks	County Planning Townships, City, Villages MSU Extension	1-3 years after adoption of the plan	Fire Wise awareness events have been held at the Cedar Area Fire & Rescue Department	#3g (Medium)
b. Continue enforcement of state fire codes regarding setback requirements	County Planning Building Department MSU Extension Emergency Management Coordinator	Ongoing	Building Safety enforces setbacks in permitting process	#26 (Medium)
c. Public education utilizing the Michigan Department of Natural Resources flyers and the Federal Emergency Management Administration information at parks and campgrounds	County Planning County Parks & Recreation MSU Extension Emergency Management Coordinator	1-3 years from adoption of the plan	MDNR places public educational flyers in place at State Park area and campground	#3h (Medium)
d. Real estate and insurance agents to distribute information	Insurance Agencies Real Estate Agencies Emergency Management Coordinator	Ongoing	No progress. This strategy is no longer included in the 2023 plan as it has been deemed unnecessary/ infeasible.	Not included in 2023 plan.
e. Assess fire suppression access and make improvements	Emergency Management Coordinator	Ongoing	Fire Chiefs incorporate routine jurisdictional assessments from their duty crews	#2a (Medium)

f. Research the Department of Natural Resources' State Forest wildfire/urban interface rules or plan	MSU Extension MDNR Emergency Management Coordinator		Local DNR Fire Supervisor has active role in our monthly County Fire Chief's Association meetings	This strategy was not specifically included in the 2023 plan due to the regular participation of MDNR Fire staff in local fire chief meetings; a related strategy would be #2 (High).
Additional 2016 Mitigation Strategies and 2023 Status				
Collaborate with governmental entities such as townships, villages, and the Grand Traverse Band of Ottawa and Chippewa Indians; organizations, businesses, and the public	Fire Wise awareness events have been held at the Cedar Area Fire & Rescue Department. Townships, villages, GTB Tribe members are a regular part of County LEPC/LPT meetings.			#3 (Medium), #3g (Medium)
Develop a multi-hazard warning plan and strategies for festivals/events.	Leelanau County now offers the Rave and Smart911 mobile emergency alert services that residents and visitors can sign up for. Most communities require events to cooperate with EM to establish Incident Action Plans for events			#3a (Medium), #7 (Medium)
Develop mutual support and aid from surrounding communities	Emergency Services Agencies have current Mutual Aid Agreements in place. Fire & EMS part of MI Mutual Aid Box Alarm System (MABAS)			#2 (High), #3 (Medium)
Incorporate the Plan's hazard mitigation concepts, strategies and policies into existing elements of the Leelanau General Plan	Related to 2016 HMP Priority Area 3: Erosion and Debris Flow Mitigation Strategies as found on Pages 6-15, 6-16, 6-17 and 8-14 and 12-17; and Priority Area 2: High Winds and Tornado Strategies on page 9-6 of the Leelanau General Plan: **Goal: Protect environmentally sensitive areas, including wetlands, dunes, steep slopes, shorelands, and wildlife corridors.** **Objective:** To initiate proactive measures to protect and enhance environmentally sensitive areas. **Action Statement:** Distribute information identified on the Geographic Information System (GIS) for farmland and environmentally sensitive areas, to various county agencies and local governments, and interested parties such as developers and landowners. **Action Statement:** Establish overlay zoning districts for environmentally sensitive areas through the coordinated actions of county and local government. **Action Statement:** Encourage use of incentive programs to protect environmentally sensitive areas, as well as areas with significant open space and/or scenic vistas. These incentives programs would include the acquisition of fee simple or conservation easements by non-profit organizations. The incentive program should place an emphasis on "filling gaps" between existing preservation holdings to increase ownership of contiguous areas. **Action Statement:** County and local governments should Initiate efforts to establish common protective measures for environmentally sensitive areas that fall across multiple jurisdictions. **Action Statement:** Develop and enact model flexible site development standards to minimize topographic changes, reduce the extent of paved areas, and avoid environmentally sensitive areas wherever possible.			#1 (High)

	Goal: Protect air and water quality **Objective:** County and local governments should initiate proactive measures to monitor and protect air, groundwater, and surface waters. **Action Statement:** Encourage township use of the EGLE's "County and State Environmental permits checklist" and a hazardous reporting form to ensure environmental issues are adequately considered in the local zoning process. **Goal: Protect farmland and open space protection, including scenic vistas/corridors.** **Objective:** Protect farmland and minimize consumption of open space, including scenic vistas and corridors, from loss through land fragmentation and/or development. **Action Statement:** County Planning should assist local governments by providing model regulations to encourage clustering of new residential development in order to minimize consumption of open space and scenic vistas. **Action Statement:** County and local governments should encourage landowners to research and utilize local programs which focus on timberland, wildlife, wildlife corridors, and other natural resources. **Action Statement:** The County should help provide information and materials to educate citizens and local governments about farmland protection options, including capturing the development value of their land. **Action Statement**: The county and local governments should establish future Land Use Plans that focus development in or immediately adjacent to existing villages. **Goal: Stormwater management.** **Objective:** County and local governments should coordinate regulations and programs to assure the adequate management of stormwater as a result of new construction activities. **Action Statement:** The County Drain Commissioner's office should work with local governments and the County on long range comprehensive stormwater management programs for the purpose of educating the public on related issues and facilitating communication and coordination between stormwater management initiatives and projects. **Action Statement:** Local governments should adopt subdivision and related development regulations, or coordinate local provisions with any relevant County regulations. These should include provisions that comply with the Michigan Natural Resources Act, Act 451, Part 91, to protect against floods, soil erosion, and sedimentation.	

	Goal: To have telephone, cell phone, broadband, electric, gas, and alternative energy in adequate capacity. **Objective:** Ensure environmental protection, while providing adequate utility services. **Action Statement:** Local governments should adopt zoning and subdivision regulations which require the placement of utilities below ground in all cases where practically feasible, and deal with placement, construction, collocation, modification and abandonment of wireless service facilities. **Goal: Encourage commercial development that is reflective of the character of Leelanau County.** **Objective:** Low density compatible uses should be encouraged by the creation of flexible zoning and incentive programs for private landowners who commit their land to uses which enhance the scenic resources and the public investment in parks. **Action Statement:** Local governments should create incentive programs which have the effect of decreasing residential density on appropriate land adjacent to public parks. Acquisition of conservation easements could be used as the preferred method for preserving scenic land in private ownership near the parks. **Action Statement:** Local plans and zoning ordinances should recognize the importance of preserving scenic open space near parks. Local government units may create ordinances which encourage low density and/or clustered development and quality commercial development in villages adjacent to parks. Such zoning should be compatible with incentive programs to preserve land and should include site plan review provisions for new development near existing parks. **Objective:** Regulations to protect inland lakes from the effects of keyholing and shoreline erosion and fertilization should be established and implemented. **Action Statement:** Keyhole regulations should recognize the importance and legitimacy of public access to inland lakes and not work to thwart efforts to increase public access promoted by other policies in this plan. Different types of public access can be provided for (e.g., for recreation, or for fire trucks to draw water in an emergency). **Action Statement:** Local governments should adopt greenbelt regulations for lakes and streams that require setback areas with native vegetation and limited tree removal. **Action Statement:** Local governments, with the assistance of the County, should work to develop keyholing and greenbelt regulations that are consistent across jurisdictions.	

APPENDIX D – Consideration of Alternative Strategies for 2023 Plan

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.
Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

	Hazard Mitigation Alternatives for General Thunderstorm Hazards, Hail, and/or Lightning
✓	Increased coverage and use of NOAA Weather Radio, and public early warning systems and networks.
✓	Buried/protected power and utility lines. (NOTE: Where appropriate: Burial may sometimes cause additional problems and costs in cases where eventual cable breakages are harder to locate and more expensive to repair.)
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Using structural bracing, window shutters, laminated glass in window panes, and impact-resistant roof shingles to minimize damage to public and private structures.
	Moving vehicles into garages or other covered areas.
	Installing lightning protection devices on the community's communications infrastructure and critical structures. More widespread use of lightning protection devices might also occur.
	Purchase of insurance that includes coverage for hail damage.
	Using surge protectors on critical electronic equipment.

	Hazard Mitigation Alternatives for Tornadoes and Severe Winds
✓	Increased coverage and use of NOAA Weather Radio, or comparable device-based notifications.
✓	Public early warning systems and networks.
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Buried/protected power and utility lines. (NOTE: Where appropriate. Burial may cause additional problems and costs when breakage or malfunction occurs, due to the increased difficulty in locating and repairing the problem.)
✓	Using appropriate wind engineering measures and construction techniques (e.g. structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced entry and garage doors, window shutters, waterproof adhesive sealing strips, and interlocking roof shingles) to strengthen public and private structures against severe wind damage.
✓	Proper anchoring of manufactured homes and exterior structures such as carports and porches.
✓	Securing loose materials, yard, and patio items indoors, or where winds cannot blow them about. *(Advice to be provided in public outreach efforts).*
✓	Construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas or event locations.

	Hazard Mitigation Alternatives for the Extreme Temperatures Hazard
✓	Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
✓	Increased coverage and use of NOAA Weather Radio.
✓	Provide and publicize designated heating and cooling centers within the community, where persons in need may go to obtain relief from outdoor temperatures.

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.

Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

	Hazard Mitigation Alternatives for Winter Weather Hazards (Includes snowstorms, ice & sleet storms)
✓	Increased coverage and use of NOAA Weather Radio.
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Buried/protected power and utility lines. (NOTE: Where appropriate. Burial may cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing the problem.)
✓	Establishing heating centers/shelters for vulnerable populations.
✓	Home and public building design and maintenance to prevent roof and wall damage from "ice dams."
✓	Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and storage, etc.
	Agricultural activities to reduce impacts on crops and livestock.
	Pre-arranging for shelters for stranded motorists/travelers, and others.
	Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.

	Hazard Mitigation Alternatives for Fluvial (Riverine) Flooding
✓	Floodplain management–planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
	Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
✓	Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
	Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
✓	Elevation of flood-prone structures above the 100-year flood level.
✓	Purchase or transfer of development rights - to discourage development in floodplain areas.
	"Floating" architectural designs for structures in flood-prone areas.
✓	Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
✓	Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
✓	Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
✓	Protection (or restoration) of wetlands and natural water retention areas.
✓	Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
	Joining the National Flood Insurance Program (NFIP).
	Obtaining flood insurance. (Requires community participation in the NFIP.)
	Participation in the Community Rating System (CRS).

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.

Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

	Hazard Mitigation Alternatives for Urban Flooding
✓	Stormwater management–Adequate design, installation, maintenance, and monitoring of municipal storm sewer systems. Ordinances or amendments to assist in stormwater management (e.g. forbidding illicit discharges). Planning for and regulating areas prone to flooding (acceptable uses and development restrictions through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, purchased or transferred development rights, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
	Homeowner's and rental insurance that includes coverage of damages and cleanup of sewer backflow impacts.
✓	Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, flood gates and pumps, wetlands protection and restoration).
✓	Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
✓	Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
✓	Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
✓	Farmland and open space preservation.
	Elevating mechanical and utility devices above expected flood levels.
	Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
✓	Increased coverage and use of NOAA Weather Radio.
	Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas and erosion areas.
✓	Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs. *(Advice to be provided in public outreach efforts).*
✓	Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure clear drainage infrastructure.
	Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
✓	Increasing the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
✓	Wetlands protection regulations and policies.
	Use of check valves, sump pumps and backflow preventers in homes and buildings.
	Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
✓	Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
✓	Protection (or restoration) of wetlands and natural water retention areas.
✓	Landslide mitigation ideas: Do not build houses, buildings, parks, or playgrounds close to steep slopes; install flexible pipe fittings to avoid gas and water line breakage.

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.

Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

Hazard Mitigation Alternatives for Dam Failures	
✓	Regular inspection and maintenance of dams.
	Garnering community support for a funding mechanism to assist dam owners in the removal or repair of dams in disrepair.
	Regulate development in the dam's hydraulic shadow (where flooding would occur if a severe dam failure occurred).
✓	Ensuring that dams meet or exceed the design criteria required by law.
✓	Public warning systems.
	Obtaining insurance.
✓	Increased coverage and use of NOAA Weather Radio
	Increased funding for dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.
	Constructing emergency access roads to dams, where needed.
	Pump and flood gate installation/automation.

Mitigation Alternatives for Drought Hazard	
	Storage of water for use in drought events (especially for human needs during periods of extreme temperatures, and for responding to structural fire and wildfire events).
✓	Legislative acts, local ordinances, and other measures to prioritize or control water use.
✓	Encouragement of water-saving measures by consumers (including landscaping, irrigation, farming, lower priority lawn maintenance, and non-essential auto washing).
✓	Anticipation of potential drought conditions, and the preparation of drought contingency plans.
	Designs, for recreational and other water-related structures and land uses, that take into account the full range of water levels (of lakes, streams, and groundwater).
	Designs and plans for water delivery systems that include a consideration of drought events.
	Obtaining agricultural insurance.

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.
Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

	Hazard Mitigation Alternatives for Wildfire Hazard *(Note: Many of these actions are included in the Firewise USA public education program on wildfire preparedness)*
✓	Proper maintenance of property in or near wildland areas (including short grass; thinned trees and removal of low-hanging branches; selection of fire-resistant vegetation; use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains securely away from windows or using heavy fire-resistant drapes; creating and maintaining a buffer zone (defensible space) between structures and adjacent wild lands; use of the fire department's home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on houses; thorough cleaning-up of spilled flammable fluids; and keeping garage areas protected from blowing embers).
✓	Safe disposal of yard and house waste rather than through open burning. *(Advice to be provided in public outreach efforts).*
	Use of fire spotters, towers, planes.
✓	Use of structural fire mitigation systems such as interior and exterior sprinklers, smoke detectors, and fire extinguishers.
✓	Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and lands with a history of flammable substances stored, spilled, or dumped on them).
✓	Public notification of fire weather and fire warnings.
✓	Prescribed burns and fuel management (thinning of flammable vegetation, possibly including selective logging to thin out some areas. Fuels cleared can be given away as firewood or made into wood chips for distribution.)
✓	Have adequate water supplies for emergency fire-fighting (in accordance with NFPA standards).
✓	The creation of fuel breaks (areas where the spread of wildfires will be slowed or stopped due to removal of fuels, or the use of fire-retardant materials/vegetation) in high-risk forest or other areas.
✓	Keeping roads and driveways accessible to vehicles and fire equipment–driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates for properties should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly). *(Advice to be provided in public outreach efforts).*
	Enclosing the foundations of homes and buildings rather than leaving them open with their underside exposed to blown embers or materials.
	Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
	Proper maintenance and storage of motorized equipment that could catch on fire (from blown embers, etc.)
	Proper storage and use of flammables, including the use of flammable substances (such as when fueling machinery). Store gasoline, oily rags and other flammable materials in approved safety cans. Stack firewood at least 100 feet away and uphill from homes.
	Avoid building structures on hilltop locations, where they will be at greater risk from wildfires (also, hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure).
	Use of proper setbacks from slopes (outside of the "convection cone" of intense heat which would be projected up the slope of the hill as a wildfire "climbs" it).
	Obtaining insurance.

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.
Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

	Hazard Mitigation Alternatives for Invasive Species
	Restrictions on the import and transport of species carriers.
	Adjustments to hunting, fishing, and other policies and regulations related to wildlife populations.
✓	Use of barriers to prevent invasive species travel.
✓	Use of competing species or other population control techniques.

	Hazard Mitigation Opportunities for Public Health Emergencies
✓	Maintaining proper levels of PPE for healthcare workers and first responders, with additional supplies for long-term care facilities.
✓	Immunization programs to vaccinate against communicable diseases.
✓	Improving ventilation techniques in areas, facilities, or vehicles that are prone to crowding or that may involve exposure to contagion or noxious atmospheres.
✓	Maintaining community water and sewer infrastructure at acceptable operating standards.
✓	Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
✓	Demolition and clearance of vacant condemned structures to help prevent vermin infestation.
✓	Adequate community clinics and school health services.
✓	Brownfield and urban blight clean-up activities.
✓	Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
✓	Separation of storm and sanitary sewer systems.
✓	Spraying programs to properly control mosquito populations.
✓	Updated Continuity of Operations (COOP) plans and alternative "work from home" schedules.

	Hazard Mitigation Alternatives for Shoreline Flooding and Erosion
✓	Floodplain/coastal zone management – planning acceptable uses for areas prone to flooding (comprehensive planning, zoning, open space requirements, subdivision regulations, land use and capital improvements planning).
✓	Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
	Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
✓	Elevation of flood-prone structures above the 100-year flood level.
✓	Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
✓	Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
✓	Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
✓	Enforcement of basic building code requirements related to flood mitigation.
	Joining the National Flood Insurance Program, obtaining insurance, and participating in the Community Rating System (CRS).
✓	Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
	Elevating mechanical and utility devices above expected flood levels.

Hazard Mitigation Alternatives Considered for Leelanau County

A check mark indicates it was included in the list of mitigation strategies.

Sources of alternatives: Michigan State Police's *2019 Michigan Hazard Analysis* and *Hazard Analysis Supplement*

✓	Flood warning systems.
	Monitoring of water levels with stream gauges and trained monitors.
	Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be permanently relocated outside of flood-prone areas and erosion areas.
✓	Control and securing of debris, yard items, or stored objects in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs. *(Advice to be provided in public outreach efforts).*
✓	Increased coverage and use of NOAA Weather Radio.
✓	Locating structures and infrastructure landward of the established setbacks.

APPENDIX E – Participation Table

Leelanau County 2023 Hazard Mitigation Plan Participation Table

Community Representation	Organization	Representative	Title	Survey 8/4/2021-2/2/2022	HM Kick Off Meeting 7/1/2021	LPT/LEPC Meeting 08/12/2021	LPT Meeting 10/21/2021	LPT Meeting 12/9/2021	LPT Meeting 02/10/2022	Community Input Meeting on County Hazards 4/14/22	LPT/LEPC Meeting 10/13/22	LPT/LEPC Meeting 12/8/22	LPT/LEPC Meeting 2/9/23	LPT/LEPC Meeting 4/13/23	Email Correspondence April 2023	Email Correspondence June 2023
Leelanau County	Leelanau County	Matt Ansorge	E.M./911 Director	X	X		X		X	X	X	X	X	X		
		Kelly LaCross	E.M./911 Deputy Director	X		X	X	X	X	X	X			X		
		Chet Janik	Administrator (former)			X		X	X		X	X				
		Deborah Allen	Administrator (current)									X	X	X		
		William Bunek	County BOC Chair (former)				X									
		Rob Herman	GIS Analyst						X							
		Trudy Galla	Planning & Community Development Director	X						X						
		Lt. Jim Kiessel	Undersheriff			X	X	X	X	X	X	X	X	X		
		Lt. Duane Wright	Law Enforcement Lieutenant								X	X				
		April Missias	Leelanau County Senior Services Director								X	X				
		Amber Weber	Building Official/Inspector	X												
	Leelanau County Road Commission	Brendan Mullane	Managing Director	X				X	X	X	X	X				
		Jim Calhoun	Board Member							X						
		Tim Trudell	Fleet and Facilities Manager	X												
Bingham Township	Bingham Township	Marian Werner	Supervisor	X												
Centerville, Cleveland, Kasson and Solon Townships	Cedar Area Fire and Rescue	Andy Doornbos	Cedar Area Fire & Rescue, Fire Chief							X		X				
Centerville Township	Centerville Township	Jim Schwantes	Supervisor	X						X					X	
		Joe Mosher	Planning Commissioner							X						
		Tim Johnson	Planning Commissioner	X												
Cleveland Township	Cleveland Township	Tanelle Budd	Clerk	X												
Elmwood Charter Township	Elmwood Charter Township	Jeff Shaw	Supervisor	X												
	Elmwood Fire & Rescue	Keith Tampa	Elmwood Twp. Fire & Rescue, Fire Chief						X		X					
Empire Township	Empire Township	Christine Neiswonger	Clerk												X	

Leelanau County 2023 Hazard Mitigation Plan Participation Table

Community Representation	Organization	Representative	Title	Survey 8/4/2021-2/2/2022	HM Kick Off Meeting 7/1/2021	LPT/LEPC Meeting 08/12/2021	LPT Meeting 10/21/2021	LPT Meeting 12/9/2021	LPT Meeting 02/10/2022	Community Input Meeting on County Hazards 4/14/22	LPT/LEPC Meeting 10/13/22	LPT/LEPC Meeting 12/8/22	LPT/LEPC Meeting 2/9/23	LPT/LEPC Meeting 4/13/23	Email Correspondence April 2023	Email Correspondence June 2023
Glen Arbor Township	**Glen Arbor Township**	Tom Laureto	Supervisor	X												
Kasson Township	**Kasson Township**	Dana Boomer	Clerk	X						X						
		Chuck Schaeffer	Planning Commissioner; Chairman of Board of Review	X												
Leelanau Township	**Leelanau Township Fire and Rescue**	Hugh Cook	Fire Chief			X		X		X			X			
Leland Township	**Leland Township**	Clint Mitchell	Planning Commissioner							X						
	Leland Twp. Fire & Rescue	Dan Besson	Fire Chief	X						X		X				
	Leland Public Schools	Stephanie Long	Superintendent	X												
Solon Township	**Solon Township**	Stephen Yoder	Township Board Member	X												
		Kelly Claar	Township Parks Committee Chair	X												
Suttons Bay Township	**Suttons Bay Township**	Richard Bahle	Supervisor (former)	X												
		Dorothy Petroskey	Treasurer	X												
		Steve Patmore	Zoning Administrator	X												
Suttons Bay Township, Bingham Township, Village of Suttons Bay	**Suttons Bay-Bingham Fire & Rescue**	Jim Porter	Suttons Bay-Bingham Fire & Rescue, Fire Chief							X	X					
		Mark Bowen	Suttons Bay-Bingham Fire & Rescue, Captain							X						
Village of Empire	**Village of Empire**	March Dye	Trustee											X		
		Margaret Walton	Trustee											X		
		Maggie Bacon	Trustee	X												
		Derith Smith	Clerk	X												
Village of Northport	**Village of Northport**	Hugh Cook	Trustee			X		X		X			X			
		Daniel Caudill	Planning Commissioner	X												
Village of Suttons Bay	**Village of Suttons Bay**	Char Fay	Clerk	X												
Suttons Bay Township; Peshawbestown	**Grand Traverse Band of Ottawa and Chippewa Indians**	Jolanda Murphy	E.M./Public Safety	X	X		X			X	X	X	X			
		Joe Huhn	DPW Director							X						
		Nicki Basch	Housing Manager							X						
		Lori Savaso	Risk Management							X						
		Becky Oien	Tribal Manager		X											
		Sandra Dunkin	Clinical Social Worker/Program Director	X												
		Courtney Hessell	NRD Envtl. Specialist							X						
		Garrett Fairchild	Fire Chief		X	X		X	X	X	X	X		X		

Leelanau County 2023 Hazard Mitigation Plan Participation Table

Community Representation	Organization	Representative	Title	Survey 8/4/2021-2/2/2022	HM Kick Off Meeting 7/1/2021	LPT/LEPC Meeting 08/12/2021	LPT Meeting 10/21/2021	LPT Meeting 12/9/2021	LPT Meeting 02/10/2022	Community Input Meeting on County Hazards 4/14/22	LPT/LEPC Meeting 10/13/22	LPT/LEPC Meeting 12/8/22	LPT/LEPC Meeting 2/9/23	LPT/LEPC Meeting 4/13/23	Email Correspondence April 2023	Email Correspondence June 2023
Benzie County	Benzie County	Rebecca Hubers	Emergency Management Coordinator		X											
Leelanau County	Benzie-Leelanau District Health Department	Chloe Willetts	Director of Personal Health	X		X										
		Bobbi Scott	Emergency Preparedness Coordinator	X		X	X			X	X	X	X			
	American Red Cross of Northern Michigan	Megan Powers	Disaster Program Manager	X												
	Leelanau Conservancy	Gayle Egeler	Membership Coordinator	X		X			X							
	Northwest Michigan Invasive Species Network	Audrey Menninga	ISN Coordinator													X
Leland Township	Harbor Hill Fruit Farm	Nick Florip	Farm Manager							X						
Leelanau County	Heartland Hospice	Barb MacGregor	Administrator, RN, BSN	X			X							X		
City of Traverse City	Traverse City Fire Department	Jim Tuller	Fire Chief	X												
	Mobile Medical Rescue	Amy Fairchild	Operations Manager			X		X	X	X	X	X				
Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Village of Empire	National Park Service - Sleeping Bear Dunes	Andy Blake	Ranger			X										
Leelanau County	MI EGLE - RRD Cadillac District	Brian Flickinger	Project Manager			X										
	Michigan State Police	Lt. Frank Keck	Assistant District Commander	X		X										
		Tpr. Jason Tropf					X	X	X	X	X	X	X	X		
		F/Lt. Travis House	Cadillac Post Commander						X		X					
	Michigan State Police EMHSD	Lt. Michael deCastro	Michigan Critical Incident Management System Trainer							X						

APPENDIX F – Meeting and Participation Documentation

Hazard Mitigation Plan Update Kick Off Meeting

July 1, 2021, 9:30 a.m.

Networks Northwest
600 East Front Street, Suite 205
Traverse City, MI 49686
Conference Room #2

Agenda

I. Welcome

II. Introductions

III. Roles and Responsibilities
   a. Federal Emergency Management Agency
   b. Michigan State Police
   c. Networks Northwest
   d. County and Tribal Staff
   e. Local Government Staff
   f. Local Stakeholders
   g. General Public

IV. Communication

V. The Process
   a. Phase I – Obtain Public Input
   b. Phase II – Complete Hazard Analysis
   c. Phase III – Create Action Plan
   d. Phases IV – Update Plans and Maps
   e. Phase V – Facilitate Local Adoptions

VI. Project Timeline
   a. Period of Performance Expires: December 16, 2023

VII. Next Steps

Hazard Mitigation Plan Update Kick Off Meeting

July 1, 2021, 9:30 a.m.

Networks Northwest
600 East Front Street, Suite 205
Traverse City, MI 49686
Conference Room #2

I. In-person meeting location information

The Networks Northwest main office has an attached parking garage with entrances from Front Street and Railroad Avenue. Enter the building on the second floor and access Conference Room #2 through the door on the right. The conference room is down the hall on the left, past the bathrooms.

II. Remote meeting attendance

Community Planning is inviting you to a scheduled Zoom meeting.

Topic: Hazard Mitigation Kick Off
Time: Jul 1, 2021 09:30 AM Eastern Time (US and Canada)

Join Zoom Meeting
https://us02web.zoom.us/j/2319295012

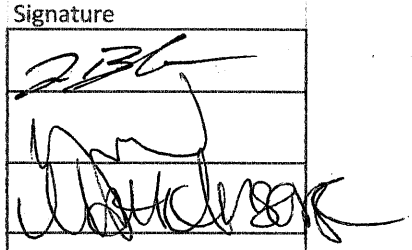
Meeting ID: 231 929 5012
One tap mobile
+16468769923,,2319295012# US (New York)
+13017158592,,2319295012# US (Washington DC)

Dial by your location
+1 646 876 9923 US (New York)
+1 301 715 8592 US (Washington DC)
+1 312 626 6799 US (Chicago)
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
Meeting ID: 231 929 5012
Find your local number: https://us02web.zoom.us/u/kbKc4W10Ib

Date: Meeting Title:

	Name	Title/ Organization	Email	Phone #	Salary Fed Funded	Miles to Mtg	Miles from Mtg
1	Travis Baker	EM Director Wexford County	tbaker@wexfordcounty.org	231-306-2130	Yes	37 47	37 47
2	Brandy Martin	Incident Commander Little River Band	brandymartin@lrboi-nsn.gov	231-398-6818	no	60	60
3	Matt Anserge	EM/911 Leelanau	manserge@leelanau.gov	231 256-8715	Yes	25	25
4	Zach Vega	comm. planner NWNW	zach.vega@networknorthwest.org	231.			
5	Rob Carson	Networks Northwest	rob.carson@networknorthwest.org	2	Yes.	45	45
6	Frank Post		Frank.Post@live.com	231-383-0558		64	64
7							
8							
9							
10							
11							
12							
13							
14							
15							

Signature



09:34:30 From Mike Sobocinski to Community Planning(Direct Message) : Mike Sobocinski, MSP/EMHSD - Position is federally funded and therefore not eligible for matching federal planning grant.
09:34:51 From Rebecca Hubers to Everyone : Rebecca Hubers - Benzie County Emergency Management / rhubers@benzieco.net / 231-882-0567
09:36:01 From PLANNING EMD to Everyone : Linda Hartshorne-Shafer, Missaukee County Planning/Emergency Management Director, planningemd@missaukee.org, 231-839-7264 Ext 3
09:36:08 From Manistee County to Community Planning(Direct Message) : Michael Machen/Deputy 911 Director/Emergency Manager/ $59,000 mmachen@manistee911.org/231-723-9970/ Yes Federally Funded
09:37:43 From Mike Thompson to Everyone : Mike Thompson, Kalkaska County Emergency Management Coordinator, mthompson@kalso.org, 231.258.3319 ext. 2229
09:37:49 From Garrett Fairchild GTB Fire Dept to Everyone : Garrett Fairchild / GTB Fire Chief / garrett.fairchild@gtbindians.com / 231-534-7161
09:40:07 From Mike Sobocinski to Community Planning(Direct Message) : Is this introduction separate from my agenda item?
09:40:40 From JAMurphy to Everyone : Jolanda Murphy, Grand Traverse Band Emergency Manager, Jolanda.murphy@gtbindians.com, 231-534-7111
09:42:22 From Becky Oien to Everyone : Rebecca Oien, Grand Traverse Band, Tribal Manager, becky.oien@gtbindians.com 231-534-7136
09:44:12 From Rebecca Hubers to Everyone : my mic must not be working
10:01:22 From Manistee County to Community Planning(Direct Message) : Lisa Sagala, Manistee County Administrator $84,,200 231-398-3501, lsagala@manisteecountymi.gov
10:02:49 From Manistee County to Community Planning(Direct Message) : Mike Szokola, Manistee County Planner, $68,500 mszokola@manisteecountymi.gov, 231-398-3527
10:10:24 From Mike Sobocinski to Everyone : FEMA Map Service Center (access to NFIP flood map information): https://msc.fema.gov/portal/home
10:11:46 From Mike Sobocinski to Everyone : FEMA has an impressive new mapping resource called the National Risk Index, providing information by county or even census tract. Risks from natural hazards, social vulnerability, etc. https://www.fema.gov/flood-maps/products-tools/national-risk-index
10:14:31 From Mike Sobocinski to Everyone : The Michigan Hazard Analysis (2019) provides an overview of natural hazards throughout Michigan. You can search the document for your county's name to find local information more quickly (Ctrl F search function)
https://www.michigan.gov/documents/msp/MHA_2019__full_update_natural_hazards_653708_7.pdf
10:38:03 From Rebecca Hubers to Everyone : I'm sorry I have to walk away now to attend another meeting - thank you

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, August 12, 2021
Time: Following the LEPC (12:00) Meeting
Location: Emergency Operations Center (EOC)

Call to Order

Approval of the LPT Meeting Minutes from Thursday, June 10, 2021.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation:
  - Networks Northwest has received grant approval
  - Public input
  - Identified hazards
    - Severe storms
    - High winds
    - Tornadoes
    - Extreme temperatures
    - Flooding
    - Shoreline hazards
    - Dam failures
    - Drought
    - Wildfires
    - Invasive species
    - Subsidence

Training and Exercise:

- Active Assailant Full Scale Exercise
  - Suttons Bay – 17 Aug 21
  - Glen Lake Schools – 24 Aug 21

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, October 14, 2021** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, August 12, 2021, immediately following LEPC meeting at 12:00pm
Location: EOC
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Undersheriff Jim Kiessel (LCSO)
Chief Hugh Cook (Northport Fire)
Gayle Egeler (Leelanau Conservancy)
Chief Garrett Fairchild (GTB Fire & Rescue)
Chloe Willetts (B-L Dist. Health Dept.)
Bobbi Scott (B-L Dist. Health Dept.)
Chet Janik (County Administrator)
Kelly LaCross (EM/911 Deputy Director)
Ranger Andy Blake (NPS)
Lt. Frank Keck (MSP)
Amy Fairchild (MMR)
Brian Flickinger (EGLE)

Membership / Others Absent:

Matt Ansorge EM/911Director/Chair)
William Bunek (B.o.C.)
Brendan Mullane (Road Commission)
Chief Andy Doornbos (CAF&R)
Lt Michael de Castro (MSP District Coord.)
Parker Ameel (MAEAP)
Chief Keith Tampa (Elmwood Fire)
Chief Dan Besson (Leland Twp Fire)
Amber Weber (Building Safety)
Jolanda Murphy (GTB Public Safety)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Barb MacGregor (Heartland Hospice)
Ron Plamondon (LCIT)
Trudy Galla (Planning Department)
Laurie Spencer (Equalization)

Meeting called to order at 12:05 pm.

Approval of the LEPC Meeting Minutes of Thursday, June 10, 2021:

MOTION by Gayle Egeler, supported by Undersheriff Jim Kiessel to approve the minutes of the June meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Undersheriff Jim Kiessel, supported by Gayle Egeler to approve the agenda for the August meeting as presented. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Emergency Management/9-1-1 - Mr. LaCross reported the following:

a. Motorola NOMAD positions (portable dispatch positions) have been received and we are currently waiting on some missing hardware.

b. Leland Active Assailant Exercise went well. We still have exercises at Suttons Bay School and Glen Lake School.

MMR – Ms. Fairchild reported the following:

a. MMR has a communications trailer w/WIFI communications available if needed for disaster assistance. The trailer is self-sufficient for a week.

b. If needed, MMR can pull ambulances from across northern Michigan.

c. Currently, MMR is short staffed.

d. MMR now has power loaders and stair chairs on all trucks.

GTB Public Safety – Chief Fairchild reported the following:

a. GTB is currently working with Networks Northwest on their Hazard Mitigation Plan.

b. COVID testing/vaccine clinics continue.

1. GTB has 5 new COVID cases.

2. 3,678 vaccines have been administered.

c. Two personnel will be attending the Active Assailant Conference.

d. GTB assisted with the Leland School Active Assailant Exercise.

e. GTB Fire & Rescue will be conducting Stop the Bleed Training

f. GTB has a D.A.R.T. (Disaster Assistance and Response Trailer) available for deployment to County agencies upon request.

Leelanau County Sheriff's Office – Lt. Kiessel reported the following:

a. LCSO is currently fully staffed.

b. One person in training to be competed mid-November.

National Park Service – Ranger Blake reported that Ranger Chalup is on a wildfire detail.

Michigan State Police – Lt. Keck reported the following:

a. Currently have three Troopers completing training.

b. Manistee has a K-9 tracking and vapor dog available if needed.

Michigan Department of Environment, Great Lakes, and Energy – Mr. Flickinger reported EGLE has had a busier summer with increased complaints.

Leelanau Township Emergency Services – NSTR

Leelanau Conservancy – Ms. Egeler reported the following:

a. The Conservancy has added new bike trails at Palmer Woods.

b. Visits have doubled for Conservancy trails this year.

Benzie-Leelanau District Health Department – Ms. Willetts reported the following:

a. B-LDHD continues with COVID case management / vaccine clinics

b. New cases are being seen mostly in the unvaccinated.

c. Vaccine clinic held each week at the Suttons Bay Gymnasium and Benzie County Crystal Café.

d. It appears that COVID-19 booster shots will be approved.

e. B-LDHD is working with schools to assist and give recommendations for the new school year.

    1. Increasing testing capacity.

    2. Main goal is to keep children in school.

f. Currently have a temporary staff plus 10 full time employees.

g. B-LDHD will resume masking indoors.

h. Ms. Willetts will be moving to the Health Department of Northwest Michigan and introduced the new B-LDHD Preparedness Coordinator Bobbi Scott

i. ICS 300/400 courses are available, contact the Region 7 Healthcare Coalition for details.

<u>Correspondence Review</u>:

Homeland Security Grant Updates:

Hazard Mitigation Grant:

a. Networks Northwest has received FEMA approval.

b. Currently seeking public input.

c. Please review the current identified hazards. A discussion regarding current hazards will be conducted at the next meeting.

- Severe storms
- High winds
- Tornadoes/straight line winds
- Extreme temperatures
- Flooding
- Shoreline hazards
- Dam failures
- Drought
- Wildfires
- Invasive species
- Subsidence

d. Bring newly identified hazards to the October meeting.

Upcoming Training and Exercise information:

1. 17 August 2021 – Active Assailant FSE Suttons Bay Public School

2. 24 August 2021 – Active Assailant FSE Glen Lake School

New Business: None

Open Discussion: None

Adjournment: meeting adjourned at 12:56pm

***MOTION* by Undersheriff Jim Kiessel, supported by Gayle Egeler to adjourn at 12:45 hrs**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, October 14, 2021**, in the EOC at noon.

Networks Northwest
Talent / Business / Community

VOLUNTEER/IN-KIND CONTRIBUTIONS

County: Leelanau County
Event Name: Hazard Mitigation Meeting
Date: 08/12/2021 Time (duration): 1 hour
Description of Activity: Hazard Mitigation Plan Meeting

This document certifies that attendees (signed below) offered match assistance, as formerly agreed upon by each County, to the Northwest Michigan Hazard Mitigation Planning Project. The time spent on this project was funded from non-federal grant sources.

NAME	Bill-out rate* per hour	Miles** (Round Trip)	Hours attended	E-mail	Signature	Total Value (NNW fills out)
Kelly LaCross	$43	0	1	KLACROSS@LEELANAU.GOV		
Chloe Willetts	$24	3	1	ccapaldi@nwhealth.org		
Hugh Cook	$45	30	1	LTES		
Gareth Fairchild		12	1	Gareth.Fairchild@GTBindians.com		
Gayle Egeler	$30	10	1	gayle@leelanaueconservancy.org	Gayle Egeler	
Andy Blake	$40	30	1	andrew.blake@dnr.gov		
Amy Fairchild	$45	38	1	afairchild@mdilamedical.org	Afairchild	
Frank Keck	$52	136	1	KECKF@michigan.gov		
J. Kiessel	$45	0	1	JKiessel@leelanau.gov		
Bobbi Scott	$30	3	1	bscott@bldhd.org		
Chey Janik	$50	0	1	[illegible]		
Brian Flickinger	$45	30	1	FLICKINGERB@MICHIGAN.GOV		
					Grand TOTAL	

*NOT wage-rate. If a bill-out rate is not offered, the NWMCOG will utilize the Bureau of Labor Statistics rate of $20.00/hour rate for *Community Volunteers.* Information received from http://www.bls.gov/oes/2010/may/oes_mi.htm Updated August 10, 2011

**Mileage rates will be calculated utilizing the Internal Revenue Service's standard rate od 56.5 cents per mile. http://www.irs.gov/uac/Newsroom/2013-Standard-Mileage-Rates-Up-1-Cent-per-Mile-for-Business-Medical-and-Moving

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, October 21, 2021
Time: Following the LEPC (12:00) Meeting
Location: Emergency Operations Center (EOC)

Call to Order

Approval of the LPT Meeting Minutes from Thursday, August 12, 2021.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation:
  - Networks Northwest has received grant approval
  - Public input
  - Identified hazards
    - Severe storms
    - High winds
    - Tornadoes
    - Extreme temperatures
    - Flooding
    - Shoreline hazards
    - Dam failures
    - Drought
    - Wildfires
    - Invasive species
    - Subsidence

Training and Exercise:

- Exercise completed for the year.

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, December 9, 2021** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, August 12, 2021, immediately following LEPC meeting at 12:00pm
Location: EOC
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

William Bunek (B.o.C.)
Jennifer Neal (Networks Northwest)
Lt. Jim Kiessel (LCSO)
Jolanda Murphy (GTB Public Safety)
Bobbi Scott (B-L Dist. Health Dept.)
William Bunek (B.o.C.)
Matt Ansorge EM/911Director/Chair)
Kelly LaCross (EM/911 Deputy Director)
Frank Post (Networks Northwest)
Barb MacGregor (Heartland Hospice)
Tpr. Jason Tropf (MSP)
Matt Ansorge EM/911Director/Chair)

Membership / Others Absent:

Chief Hugh Cook (LTES)
Ranger Andy Blake (NPS)
Brendan Mullane (Road Commission)
Amy Fairchild (MMR)
Chief Andy Doornbos (CAF&R)
Lt Michael de Castro (MSP District Coord.)
Parker Ameel (MAEAP)
Chief Keith Tampa (Elmwood Fire)
Chief Dan Besson (Leland Twp Fire)
Amber Weber (Building Safety)
Chet Janik (County Administrator)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Gayle Egeler (Leelanau Conservancy)
Ron Plamondon (LCIT)
Trudy Galla (Planning Department)
Laurie Spencer (Equalization)
Brian Flickinger (EGLE)

Meeting called to order at 12:35 pm.

Approval of the LEPC Meeting Minutes of Thursday, August 12, 2021:

MOTION by Will Bunek, supported by Undersheriff Jim Kiessel to approve the minutes of the August meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda: Mr. Ansorge requested the addition of a Networks Northwest Hazard Mitigation Overview.

MOTION by Undersheriff Jim Kiessel, supported by Will Bunek to approve the agenda for the October meeting as amended. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Emergency Management/9-1-1 - Mr. Ansorge reported the following:

a. Working on the Hazard Mitigation Plan.

b. Recently received RFPs for the new Government Center Tower and the Maple City Tower Extension. The Government Center Tower will require soil boring before solid bids can be presented.

GTB Public Safety – Ms. Murphy reported the following:

a. GTB is currently working with Networks Northwest on their Hazard Mitigation Plan.

b. COVID testing/vaccine clinics continue.

c. GTB Fire & Rescue has one vacancy.

d. GTB Tribal Police have 4 vacancies.

Leelanau County Sheriff's Office – Lt. Kiessel reported LCSO has one person in training.

Benzie-Leelanau District Health Department – Ms. Scott reported the following:

a. There are currently 3 people hospitalized with COVID.

b. COVID Positivity Rates

1. State of Michigan: 11.4%
2. Traverse City Region: 16.4%
3. Leelanau County: 5.4%
4. Benzie County: 9.4%

c. Three nurses have been assigned to support/testing teams.

Heartland Hospice – Ms. MacGregor reported the following:

a. Heartland Hospice is changing their name to ProMedica Hospice

b. Their status is changing from a non-profit organization to a for-profit organization

c. Hospice staff is 95% vaccinated against COVID-19.

Board of Commissioners – Chairman Bunek reported the following:

a. Working with Emergency Management on Tower Project.

b. Determining projects to support with American Rescue Plan funding.

Correspondence Review:

Homeland Security Grant Updates:

Hazard Mitigation Grant:

a. Jennifer Neal and Frank Post from Networks Northwest presented a Leelanau County Hazard Mitigation Plan Update. See attached slides.

b. Currently seeking public input.

Upcoming Training and Exercise information: Leelanau County Emergency Management completed 3 full scale exercises with the Leelanau County Sheriff's Office, State and Tribal Law Enforcement agencies, and County Fire Departments. All exercises went very well and improvement plans are in draft.

New Business: None

Open Discussion: None

Adjournment: meeting adjourned at 2:00pm

***MOTION* by Undersheriff Jim Kiessel, supported by Will Bunek to adjourn at 2:00pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, December 9, 2021**, in the EOC at noon.

Attachment: Leelanau County Hazard Mitigation Plan Update October 21, 2021

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, October 21, 2021

SIGN-IN SHEET

	Name (Please Print)	Agency
1	Will Bunek	BOC
2	Bobbi Scott	BLDHD
3	Barbara MacGregor	Heartland - ProMedica Hospice
4	Matt Ansorge	EM/911
5	Kelly LaCross	EM/911
6	Jennifer Neal	Networks Northwest
7	Frank Post	Networks Northwest
8	For Jason Tropf	MSP
9	Jolanda Murphy	GTB PSD-EM
10	Jim Kiessel	LCSO
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LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, December 9, 2021
Time: Following the LEPC (12:00) Meeting
Location: Emergency Operations Center (EOC)

Call to Order

Approval of the LPT Meeting Minutes from Thursday, October 21, 2021.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation:
  - Working with Networks Northwest, currently seeking public input
  - Current identified hazards:
    - Severe storms
    - High winds
    - Tornadoes
    - Extreme temperatures
    - Flooding
    - Shoreline hazards
    - Dam failures
    - Drought
    - Wildfires
    - Invasive species
    - Subsidence

Training and Exercise: No training or exercises scheduled during the first quarter of 2022.

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, February 10, 2022** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, December 9, 2021, immediately following LEPC meeting at 12:00pm
Location: EOC
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Kelly LaCross (EM/911 Deputy Director)
Hugh Cook (LTES)
Undersheriff Jim Kiessel (LCSO)
Chief Garrett Fairchild (GTBF&R)
Chet Janik (County Administrator)
Brendan Mullane (Road Commission)
Amy Fairchild (MMR)
Tpr. Jason Tropf (MSP)

Membership / Others Absent:

Matt Ansorge EM/911Director/Chair)
Ranger Andy Blake (NPS)
Bobbi Scott (B-L Dist. Health Dept.)
Barb MacGregor (Heartland Hospice)
Chief Andy Doornbos (CAF&R)
Lt Michael de Castro (MSP District Coord.)
Parker Ameel (MAEAP)
Chief Keith Tampa (Elmwood Fire)
Chief Dan Besson (Leland Twp Fire)
Amber Weber (Building Safety)
William Bunek (B.o.C.)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Gayle Egeler (Leelanau Conservancy)
Ron Plamondon (LCIT)
Trudy Galla (Planning Department)
Laurie Spencer (Equalization)
Brian Flickinger (EGLE)

Meeting called to order at 12:35 pm.

Approval of the LEPC Meeting Minutes of Thursday, October 21, 2021:

MOTION by Chief Fairchild, supported by Undersheriff Jim Kiessel to approve the minutes of the August meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Undersheriff Jim Kiessel, supported by Chief Fairchild to approve the agenda for the October meeting as amended. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Emergency Management/9-1-1 - Mr. LaCross reported the following:

a. Working on the Hazard Mitigation Plan.

b. Soil sampling has been completed for the Government Center Tower. No issues were noted. Mr. Ansorge will brief the Board of Commissioners and establish new timelines for the RFP.

GTB Public Safety – Chief Fairchild reported the following:

a. GTB LE has conditionally hired two currently enrolled in the Police Academy.

b. GTB LE has recently hired Troy Lamerson.

c. COVID testing/vaccine clinics continues. Capable of administering antibody treatments.

d. GTB Fire & Rescue is fully staffed, with two personnel in the Fire Academy

e. In the process of remodeling GTBF&R for 24hr operations

f. Regarding EMS calls, persons who are administered NARCAN can refuse transport to a hospital.

Leelanau County Sheriff's Office – NSTR

Leelanau County Administrator – Mr. Janik reported the following:

a. Leelanau County has received $4.2M in American Rescue Act Funding.

b. Special meeting on December 13, 2021 to discuss funding.

c. Leelanau County has the potential to receive more funding from the State.

d. There is movement to allocate additional funding for cell/broadband enhancement.

Leelanau County Road Commission – Mr. Mullane reported the following:

a. All projects for the year have been completed.

b. The employee labor contract has been completed. Employees to receive a 7.5% raise.

c. CDL licensing process is more complicated now.

d. Marijuana is not allowed with CDL license.

e. Starting salary for Road Commission is now $21.75.

Michigan State Police – Tpr. Tropf reported the Cadillac Post is in the process of hiring 6 personnel.

Correspondence Review:

Homeland Security Grant Updates:

Hazard Mitigation Grant:

a. Networks Northwest continues to work on the Leelanau County Hazard Mitigation Plan,

b. Jennifer Neal and Frank Post will attend the February meeting to provide an update.

Upcoming Training and Exercise information: NSTR

New Business: None

Open Discussion: None

Adjournment: meeting adjourned at 2:00pm

***MOTION* by Undersheriff Jim Kiessel, supported by Chet Janik to adjourn at 2:00pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, February 10, 2022**, in the EOC at noon.

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, December 9, 2021

SIGN-IN SHEET

	Name (Please Print)	Agency
1	KELLY LACROSS	EM/911
2	Amy Fairchild	MMR
3	Garrett Faircloth	GTB
4	James Kressel	LCSO
5	Brendan Mullane	LCRC
6	HUGH COOK	LTFD
7	Chief Yanik	Lee Co.
8	Tpr Jason Trapp	MSP
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LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, February 10, 2022
Time: Following the LEPC (12:00) Meeting
Location: Emergency Operations Center (EOC)

Call to Order

Approval of the LPT Meeting Minutes from Thursday, December 9, 2021.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation:
  - Networks Northwest update

Training and Exercise: Currently working with LE/Fire/EMS to determine exercises for 2022.

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, April 14, 2022** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, February 10, 2022, immediately following LEPC meeting at 12:00pm
Location: EOC
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Matt Ansorge EM/911Director/Chair)
Kelly LaCross (EM/911 Deputy Director)
Undersheriff Jim Kiessel (LCSO)
Chief Garrett Fairchild (GTBF&R)
Gayle Egeler (Leelanau Conservancy)
Rob Herman (LCGIS)
Chet Janik (County Administrator)
F/Lt. Travis House (MSP)
Tpr. Jason Tropf (MSP)
Amy Fairchild (MMR)
Chief Keith Tampa (ETF&R)
Brendan Mullane (LCRC)

Membership / Others Absent:

Chief Hugh Cook (LTES)
Ranger Andy Blake (NPS)
Bobbi Scott (B-L Dist. Health Dept.)
Barb MacGregor (Heartland Hospice)
Chief Andy Doornbos (CAF&R)
Lt Michael de Castro (MSP District Coord.)
Parker Ameel (MAEAP)
Chief Dan Besson (Leland Twp Fire)
Amber Weber (Building Safety)
William Bunek (B.o.C.)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Ron Plamondon (LCIT)
Trudy Galla (Planning Department)
Laurie Spencer (Equalization)
Brian Flickinger (EGLE)

Meeting called to order at 12:35 pm.

Approval of the LEPC Meeting Minutes of Thursday, December 9, 2021:

MOTION by Gayle Egeler, supported by Undersheriff Jim Kiessel to approve the minutes of the August meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Gayle Egeler, supported by Undersheriff Jim Kiessel to approve the agenda for the October meeting as amended. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Emergency Management/9-1-1 - Mr. Ansorge reported the following:

a. Tower Projects:

1) RFPs were due Feb 1, 22. Only one bid was received to construct a new tower at the Government Center to enhance broadband/cellular coverage.

2) Working with Leelanau Twp. to expand broadband/cellular coverage. Three sites have been identified; a propagation study needs to be completed to determine the best site.

3) Kasson Twp. is discussing issues regarding the Maple City Tower.

    i. The foundation was designed to accommodate a 300" tower.

    ii. The Twp. is deciding on whether to extend the tower or leave at 195'.

    iii. It will be cheaper to construct a new tower than extend the current tower. The current tower is not manufactured anymore and would require a special build to extend.

b. GTB Tribal Police is using the same database as LCSO for records management.

GTB Public Safety – Chief Fairchild reported the following:

a. GTBF&R had two volunteers finish the fire academy.

b. GTB LE is conducting interviews

c. Carbon dioxide detectors are being installed in the hotel.

d. Mary Ladd was recently hired by GTB.

e. Michigan Works will be putting on an EMT course for GTB. Contact Chief Fairchild for details.

f. GTB has received 4K KN95's for tribal offices.

g. Tribal email addresses will be changing to @GTB-NSN.gov. Old email addresses will forward for one year.

Leelanau County Sheriff's Office – Undersheriff Kiessel reported LCSO is fully staffed and trained.

Leelanau County Administrator – Mr. Janik reported the following:

a. The B.o.C. has committed $5M to broadband improvement.

b. Leelanau/Solon/Kasson Twp.'s are the most impacted areas.

c. Point Communications, Spectrum, and Cherryland have provided proposals for broadband improvement.

d. There are roughly 5K homes that will be impacted by broadband improvements.

e. $5.6B is still uncommitted by the State of Michigan.

Leelanau County Road Commission – Mr. Mullane reported the following:

a. Working through staffing issues, currently down four people.

b. Looking at replacing fire alarms at the Road Commission building.

Michigan State Police – F/Lt. House reported the following:

a. Tpr. Tropf introduced new Cadillac Post Commander F/Lt. House.

b. The Cadillac Post is working through staffing issues.

c. Discussed the Benzie County homicide.

MMR – Ms. Fairchild reported the following:

a. Conducting interviewing for an open position.

b. A dedicated ECHO unit is being considered for Leelanau County responses. Could be in place as early as April.

Leelanau Conservancy – Ms. Egeler reported the following:

a. Conservancy personnel are still working mainly from home.

b. The Conservancy has hired four personnel, 3 from AmeriCorps.

Elmwood Twp. Fire and Rescue – Chief Tampa reported the following:

a. Working through COVID issues, ETF&R fully staffed.

b. Engine down for maintenance issues.

Leelanau County GIS – Mr. Herman reported the following:

a. Mr. Herman introduced himself to the group.

b. Working on Fire Box maps for Elmwood Twp. Fire & Rescue.

Correspondence Review:

Homeland Security Grant Updates:

Hazard Mitigation Grant:

a. Networks Northwest provided an update to the group on progress they have made toward the completion of the Hazard Mitigation Plan.

Upcoming Training and Exercise information: There will be a course on High-Risk Incident Command put on by Grand Traverse County Emergency Management in April. Please contact Leelanau County Emergency Management for registration information.

New Business: None

Open Discussion: None

Adjournment: meeting adjourned at 1:50pm

***MOTION* by Undersheriff Jim Kiessel, supported by Gayle Egeler to adjourn at 1:50pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, April 14, 2022**, in the EOC at 12:30.

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1
8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, February 10, 2022

SIGN-IN SHEET

	Name (Please Print)	Agency
1	MATT ANSORGE	EM/911
2	KELLY LACROSS	EM/911
3	Gayle Egeler	Leelanau Conservancy
4	Travis House	MSP- cadillac
5	KEITH TAMPA	Elmwood FD
6	Tpr Jason Trapp	MSP
7	Brandon Mullane	LC Road Comm
8	Robert Herman	LC GIS
9	James Kiessel	LCSO
10	Amy Fairchild	MMR
11	Garrett Fairchild	GTB
12		ADMINISTRATOR
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LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1
8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, October 13, 2022

SIGN-IN SHEET

	Name (Please Print)	Agency
1	Matt Ansorge	Leelanau EM/911
2	April Missias	LCSS
3	Bridlar Mullane	LCRC
4	Amy Fairchild	MMR
5	Chet Janik	Lee Co
6	Jason Trapf	MSP
7	Bobbi Scott	BLDHD
8	Garrett Fairchild	GTD
9	Dunne Wright	LCSO
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LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, October 13, 2022, at 12:30 am
Location: Leelanau County Emergency Operations Center
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Matt Ansorge EM/911Director/Chair)
Kelly LaCross (EM/911 Deputy Director)
Undersheriff Jim Kiessel (LCSO)
Chief Jim Porter (SBBF&R)
Chief Garrett Fairchild (GTBF&R)
Bobbi Scott (B-L Dist. Health Dept.)
Lt. Travis House (MSP)
Amy Fairchild (MMR)
Chief Keith Tampa (ETF&R)
Chet Janik (Leelanau County)
Jolanda Murphy (GTB Public Safety)

Membership / Others Absent:

Ranger Andy Blake (NPS)
Barb MacGregor (Heartland Hospice)
Parker Ameel (MAEAP)
Amber Weber (Building Safety)
Laurie Spencer (Equalization)
Trudy Galla (Planning Department)
Brian Flickinger (EGLE)
Brendan Mullane (LCRC)
Chief Dan Besson (Leland Twp Fire)
Lt. Michael de Castro (MSP EMHSD)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Ron Plamondon (LCIT)
Ty Wessell (B.o.C.)
Chief Hugh Cook (LTES)
Joe Huhn (GTB DPW)

Meeting called to order at 12:35 pm.

Approval of the LEPC Meeting Minutes of Thursday, August 11, 2022:

MOTION by Chief Garrett Fairchild, supported by Lt. Duane Wright to approve the minutes of the August meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Chief Garrett Fairchild, supported by Lt. Duane Wright to approve the agenda for the October meeting as presented. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Hazard Mitigation Grant:

- Networks Northwest is on track with the Hazard Mitigation Plan.

- A draft plan has been presented and is being reviewed by County officials.

Emergency Management/9-1-1 - Mr. Ansorge reported the following:

a. New employee starting October 24, 2022.

b. 2 Dispatchers are leaving the Center, conducting Dispatch Testing October 21, 2022.

c. Currently working through EOC upgrades.

d. Will be working on an RFP for the Leelanau Twp. Tower in the near future.

GTB Fire & Rescue – NSTR

Leelanau County Sheriff's Office – Lt. Wright reported the following:

a. Marine Patrol officially closed October 7, 2022. Can still respond to marine emergencies but there are no Marine Patrol personnel on duty

b. LCSO is fully staffed.

Michigan State Police – Tpr. Tropf reported the following:

a. T.C. Post reopening Jan 1, 2023.

b. Stephen Porter from Houghton Lake Post has been hired as Post Commander.

c. Tropf will stay on as Leelanau Trooper.

d. Currently bringing T.C. Post up to code.

e. 20 Troops will be assigned at the T.C. Post.

f. Benzie call volume 2:1 and Grand Traverse 20:1 over Leelanau call volume.

g. 2 Grand Traverse deputies are moving to MSP.

MMR – Ms. Fairchild reported the following:

a. Lost two paramedics, gained one, five graduating on Saturday.

b. Eight in EMT class.

c. Lucas Devices will be in all trucks by the end of the year.

Benzie/Leelanau District Health Department: Ms. Scott reported the following:

a. Continuing testing and vaccine clinics @ both offices.

b. Maple Valley Nursing Home is short staffed for nurses. Region 7 Healthcare Coalition is asking for volunteers for all shifts.

c. Monkeypox cases are currently stagnant.

Leelanau County Administrator: Chet Janik reported the following:

a. Working through the County budget process.

b. The County is moving its focus to the Leelanau Township tower project.

Leelanau County Road Commission: Mr. Mullane reported the following:

a. Working to fill open positions.

b. Discovered snow this morning in the County.

c. Summer projects are wrapping up, doing vehicle maintenance until snow arrives.

d. New plow trucks are being delivered, equipping other trucks.

Leelanau County Senior Services: Ms. Massias reported the following:

a. Fall letter going out to Seniors regarding unmet needs, and checking smoke alarms.

b. Proactive in planning for emergencies with customers

c. Working with Benzie/Leelanau Health Department to schedule vaccines for Seniors.

d. In need of assistance for Meals on Wheels deliveries.

e. Resuming educational services that had been cancelled due to Covid.

Correspondence Review:

Homeland Security Grant Updates: NSTR

Upcoming Training and Exercise information:

- December 15, 2022 – Fuel Spill TTX with Suttons Bay Village Office and Marina.

New Business: None

<u>Open Discussion</u>:

- **State Road Committee Emergency Playbook –** Mr. Mullane received State Road Committee Emergency Playbooks from the State. He will provide a copy to Emergency Management.

- **MI-Mutual Aid Box Alarm System Deployments:**

  - County Fire Departments notified for two deployments – Hurricane Ian and Menominee Paper Mill Fire.

  - Started to gear up for Hurricane Ian deployment but were not needed.

  - 2 Engines and multiple personnel deployed for 5 days to the Menominee Paper Mill Fire.

<u>Adjournment</u>: meeting adjourned at 1:15pm

***<u>MOTION</u>* by Chief Garrett Fairchild, supported by Lt. Duane Wright to adjourn at 1:15pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, December 8, 2022**, in the EOC at 12:30.

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, December 8, 2022
Time: Following the LEPC (12:00 pm) Meeting
Location: Emergency Operations Center (EOC)

Call to Order

Approval of the LPT Meeting Minutes from Thursday, October 13, 2022.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation update – Draft Hazard Mitigation Plan Update

Training and Exercise:

- December 15, 2022 – Suttons Bay Marina Spill TTX
- February 21-22, 2022 – Joint USCG, GT & Leelanau County FSE

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, February 9, 2023** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1
8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, December 8, 2022

SIGN-IN SHEET

	Name (Please Print)	Agency
1	Matt Arsenge	EM/911
2	Deborah Allen	CA
3	Amy Deerhake	CAFR
4	Yolanda Murphy	GTB PS Dept
5	Amy Fairchild	mmR
6	James C. Kiessel	LCSO
7	Garrett Fairchild	GTB
8	Brendan Mullane	LC RC
9	Tpr Jason Tropf	MSP
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LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, December 8, 2022, at 12:30 am
Location: Leelanau County Emergency Operations Center
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Matt Ansorge EM/911Director/Chair)
Brendan Mullane (LCRC)
Undersheriff Jim Kiessel (LCSO)
Chief Andy Doornbos (CAF&R)
Chief Garrett Fairchild (GTBF&R)
Jennifer Neal (Networks Northwest)
Tpr. Jason Tropf (MSP)
Amy Fairchild (MMR)
Chief Dan Besson (Leland Twp Fire)
Deborah Allen (Leelanau County)
Jolanda Murphy (GTB Public Safety)
Stephanie Marchbanks (Networks Northwest)

Membership / Others Absent:

Kelly LaCross (EM/911 Deputy Director)
Ranger Andy Blake (NPS)
Barb MacGregor (Heartland Hospice)
Parker Ameel (MAEAP)
Amber Weber (Building Safety)
Laurie Spencer (Equalization)
Trudy Galla (Planning Department)
Brian Flickinger (EGLE)
Bobbi Scott (B-L Dist. Health Dept.)
Lt. Michael de Castro (MSP EMHSD)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Ron Plamondon (LCIT)
Ty Wessell (B.o.C.)
Chief Hugh Cook (LTES)
Joe Huhn (GTB DPW)
Chief Keith Tampa (ETF&R)

Meeting called to order at 12:43 pm.

Approval of the LEPC Meeting Minutes of Thursday, October 13, 2022:

MOTION by Undersheriff Jim Kiessel, supported by Chief Garrett Fairchild to approve the minutes of the October meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Undersheriff Jim Kiessel, supported by Chief Garrett Fairchild to approve the agenda for the December meeting as presented. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Hazard Mitigation Grant:

- Networks Northwest reviewed draft strategies with the group.

- A draft plan is being reviewed by County officials.
- See attached briefing slides for update.

Emergency Management/9-1-1 - Mr. Ansorge reported the following:

a. Two personnel are in training.

b. Awaiting natural gas hookup for the Government Center Tower.

c. Will be working on an RFP for the Leelanau Twp. Tower in the near future.

GTB Fire & Rescue – Chief Fairchild reported the following:

a. Offered a position to new candidate.

b. One FF in EMT school.

c. Free concerts at Leelanau Sands through December.

d. Chili Cook-off the afternoon of Jan 14, 2023 at the Casino.

e. Jan 28-29 there will be snowmobile drag races at the Meijer property.

Leelanau County Sheriff's Office – Lt. Wright reported LCSO is fully staffed in the Jail and on the road.

Michigan State Police – Tpr. Tropf reported the following:

a. T.C. Post reopening Jan 8, 2023.

b. Stephen Porter from Houghton Lake Post has been hired as Post Commander.

c. The Post will be manned with 21 personnel increasing to 26-28 hopefully.

MMR – Ms. Fairchild reported the following:

a. 4 of 5 graduates on the road, one still needs final testing.

b. 3-year contract has been completed to provide EMS services for Traverse City.

Leelanau County Administrator: Deb Allen reported the following:

a. Finance Director position is open.

b. There was a mis-statement in the Leelanau Enterprise regarding the Finance position recommendation.

Leelanau County Road Commission: Mr. Mullane reported the following:

a. The winter weather has been good so far, one event so far this year.

b. Maple City office is fully staffed, down four in Suttons Bay.

c. New sand delivery mechanisms are in place on trucks and working well.

GTB Public Safety: Ms. Murphy reported the following:

a. P.D. is fully staffed, two complete FTO next week.

b. GTB Government offices will be closed 12/23-12/26.

c. Spill TTX has been rescheduled to April.

d. New generators to be operational at the end of the month.

Leland Twp. Fire & Rescue: Chief Besson reported the following:

a. Two new full-time personnel have started.

b. Full-time member is stepping back to part-time to attend school.

c. Engine 511 is out of service due to electrical issues.

d. Ladder 531 is out of service.

Cedar Area Fire & Rescue: Chief Doornbos reported the following:

a. Collecting requirements for a new ambulance – 3 year wait on new orders.

b. 2nd medic passed their school and have submitted for license.

c. Will be posting for 3 positions in January.

d. CDE292 will be coming back.

Correspondence Review:

Homeland Security Grant Updates: NSTR

Upcoming Training and Exercise information:

- December 15, 2022 – Fuel Spill TTX with Suttons Bay Village Office and Marina.

New Business: None

Open Discussion:

Adjournment: meeting adjourned at 1:40pm

***MOTION* by Chief Garrett Fairchild, supported by Lt. Duane Wright to adjourn at 1:40pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, February 9, 2023**, in the EOC at 12:30.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, February 9, 2023, at 12:20 am
Location: Leelanau County Emergency Operations Center
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Matt Ansorge EM/911Director/Chair)
Undersheriff James Kiessel (LCSO)
Jolanda Murphy (GTB Public Safety)
Bobbi Scott (B-L Dist. Health Dept.)
Deborah Allen (County Administrator)
Tpr. Jason Tropf (MSP)
Chief Hugh Cook (LTES)
Jennifer Neal (Networks Northwest)

Membership / Others Absent:

Ranger Andy Blake (NPS)
Brendan Mullane (LCRC)
Barb MacGregor (Heartland Hospice)
Parker Ameel (MAEAP)
Amber Weber (Building Safety)
Laurie Spencer (Equalization)
Trudy Galla (Planning Department)
Brian Flickinger (EGLE)
Chief Dan Besson (Leland Twp Fire)
Lt. Michael de Castro (MSP EMHSD)
Amy Fairchild (MMR)
Ruth Blick (Salvation Army)
Gary Frederickson (Agriculture)
Meghan Powers (Red Cross)
Ron Plamondon (LCIT)
Ty Wessell (B.o.C.)
April Missias (LCSS)
Joe Huhn (GTB DPW)

Meeting called to order at 12:20 pm.

Approval of the LEPC Meeting Minutes of Thursday, December 8, 2022:

MOTION by Undersheriff Jim Kiessel, supported by Chief Hugh Cook to approve the minutes of the December meeting as presented. ALL AYES MOTION CARRIES

Approval of today's agenda:

MOTION by Undersheriff Jim Kiessel, supported by Bobbi Scott to approve the agenda for the February meeting as presented. ALL AYES MOTION CARRIES

Reports from Other Departments/Committees:

Hazard Mitigation Grant:

a. Hazard Mitigation plan is near completion.

b. Plan needs to be completed by Dec 23, 2023.

c. Identified mitigation strategies = potential projects for County agencies - need to provide when and priority regarding the strategies identified.

d. The April LPT Meeting will be the Public Hearing Meeting for the County Hazard Mitigation Plan.

Emergency Management/9-1-1 - Mr. Ansorge reported the following:

a. Two new personnel have recently been hired.

b. Soil boring is being accomplished for the Leelanau Twp Tower on Feb 15, 2023.

GTB Public Safety – Jolanda Murphy reported the following:

a. A new fire fighter will be starting next week.

b. One LE officer out on FMLA leave.

c. Multiple staff going to the Center for Domestic Preparedness for training.

Leelanau County Sheriff's Office – Undersheriff Kiessel reported the following:

a. Currently down one on the law enforcement side.

b. One jail employee out on medical leave.

Michigan State Police – Tpr. Tropf reported the following:

a. T.C. Post is open, regular foot traffic at the Post now.

b. Down four personnel due to medical and paternity leave.

Leelanau County Administrator: Deborah Allen reported the following:

a. Will be attending MI Municipal Risk Mgmt Authority Active Shooter Training.

b. There is a Campus Security Meeting tomorrow.

c. Work is being conducted on installing an oven and new kitchen electrical for the Dispatch Center.

Leelanau/Benzie Health Department: Bobbi Scott reported the following:

a. COVID Clinics will now be called Immunization Clinics.

b. Paul Oliver Clinic is expected to be completed Feb 24, 2023.

c. Free COVID Home Test Kits are available for free at Leelanau and Benzie Clinics.

d. Conducting preparedness and training drills at both County locations.

Correspondence Review:

Homeland Security Grant Updates: NSTR

Upcoming Training and Exercise information: NSTR

New Business: None

Open Discussion:

Adjournment: meeting adjourned at 1:00pm

***MOTION* by Undersheriff James Kiessel, supported by Bobbi Scott to adjourn at 1:00pm**
ALL AYES MOTION CARRIES

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, April 13, 2023**, in the EOC at 12:30.

---------- Forwarded message ---------
From: **James Schwantes** <centervillesupervisor@gmail.com>
Date: Wed, Apr 12, 2023 at 11:13 AM
Subject: Re: Leelanau County NFIP Communities
To: Jennifer Neal <jennifer.neal@networksnorthwest.org>

Good morning Ms. Neal,
Centerville Township is adopting updated ordinances this month that continue the ordinances passed in 2018 designating the Leelanau Building Code office as the managing and enforcing agency for Floodplain Management.
I hope this answers your questions.
Best,
Jim

On Tue, Apr 11, 2023 at 2:09 PM Jennifer Neal <jennifer.neal@networksnorthwest.org> wrote:

> Good afternoon,
>
> According to our records your community is a participating community in the National Flood Insurance Program. As part of the Leelanau County Hazard Mitigation Plan update, FEMA is asking additional questions about your NFIP participation. Could you please respond with an answer to the following questions?
>
> 1. Your implementation method: How are local floodplain management regulations implemented and enforced in Special Flood Hazard Areas?
> 2. Appointed Designee: Who is the designee or agency that is appointed to implement the addressed commitments and requirements of the NFIP?
> 3. Implementation of Damage Provisions: How do participants (your community) implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.
>
> Please do not hesitate to contact me if you have any questions. Best regards,
>
> Jenni
>
> --
> **Jennifer Neal, AICP**
> **Community Planner**
> Mobile: 231.709.3204
> jennifer.neal@networksnorthwest.org
>
> Networks Northwest
> 2240 Mitchell Park Dr., Suite B
> Petoskey MI 49770

--
Jim Schwantes
Supervisor, Centerville Township
5001 S French Rd
Cedar, MI 49621
231-920-5204

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/ 9-1-1

8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

LOCAL PLANNING TEAM (LPT)
AGENDA

Date: Thursday, April 13, 2023
Time: Following the LEPC (12:00 pm) Meeting
Location: Lower-Level Meeting Room in the Government Center

Call to Order

Approval of the LPT Meeting Minutes from Thursday, February 9, 2023.

Approval of Agenda

Reports from Other Departments/Committees

- Everyone provides a brief overview of what is going on in their department/committee

Correspondence / Review:

Homeland Security Grant Updates:

- Hazard Mitigation update – Public review of the draft Hazard Mitigation Plan.

Training and Exercise:

1. Great Lakes Homeland Security Conference – May 9-11, 2023.
2. Dispatch Relocation Exercise – June 2023.

New Business

Open Discussion

Meeting Adjourned

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, June 8, 2023** in the **EOC**. The LEPC meeting will begin at 12:00pm and the LPT meeting will follow.

LOCAL PLANNING TEAM (LPT) MEETING MINUTES

Date: Thursday, April 13, 2023, at 12:05 pm
Location: Leelanau County Emergency Operations Center
8525 E. Government Center Dr.
Suttons Bay, MI 49682

Membership and Others Present:

Matt Ansorge (EM/911Director/Chair)
Kelly LaCross (EM/911 Dep. Director)
Undersheriff James Kiessel (LCSO)
Barb MacGregor (Heartland Hospice)
Chief Garrett Fairchild (GTBF&R)
Margaret Walton (Village of Empire)
Tpr. Jason Tropf (MSP)
Deborah Allen (LC Administrator)
Stephanie Marchbanks (Networks Northwest)
Jennifer Neal (Networks Northwest)
March Dye (Village of Empire)

Membership / Others Absent:

Ty Wessell (B.o.C.)
Trudy Galla (Planning Department)
Liana Wilson (LCIT)
Brendan Mullane (LCRC)
Bobbi Scott (B-L Dist. Health Dept.)
Jolanda Murphy (GTB Public Safety)
Amy Fairchild (MMR)
Ranger Andy Blake (NPS)
Lt. Michael de Castro (MSP EMHSD)
Brian Flickinger (EGLE)
Gary Frederickson (Agriculture)
Gayle Egeler (Leelanau Conservancy)
Meghan Powers (Red Cross)
Ruth Blick (Salvation Army)

Meeting called to order at 12:05 pm.

The meeting started at its regularly scheduled time of 12:00pm with only six board members in attendance. LEPC By-Laws establish a quorum with the presence of one third or more of the members present. Members in attendance were presented with an overview of the draft Leelanau County Hazard Mitigation Plan.

Reports from Other Departments/Committees:

Hazard Mitigation Grant:

a. Public meeting to review the draft Leelanau County Hazard Mitigation Plan.

b. Hazard Mitigation plan is near completion.

c. Plan needs to be completed by Dec 23, 2023.

d. Identified mitigation strategies = potential projects for County agencies - need to provide when and priority regarding the strategies identified.

Correspondence Review:

Homeland Security Grant Updates: NSTR

Upcoming Training and Exercise information:

1. Great Lakes Homeland Security Conference – May 9-11, 2023.
2. Dispatch Relocation Exercise – June 2023.

New Business: None

Open Discussion: None

Adjournment: meeting adjourned at 1:15 pm

The next combined **LEPC/LPT** meeting is scheduled for **Thursday, June 8, 2023**, in the EOC at 12:30.

LEELANAU COUNTY
OFFICE OF EMERGENCY MANAGEMENT/9-1-1
8525 E. Government Center Drive Suttons Bay, MI 49682 Phone (231) 256-8775 Fax (231) 256-8701

Leelanau County LEPC/LPT Meeting

Thursday, April 13, 2023

SIGN-IN SHEET

	Name (Please Print)	Agency
1	MATT ANSORGE	EM / 911
2	KELLY LACROSS	EM/911
3	March Rye	Village of Empire
4	Mey Watkins	Village of Empire
5	Deborah Allen	County Admin.
6	Barb MacGregor	ProMedical Hospice
7	James Kressel	LCSO
8	Scott Fairchild	GTB
9	Jason Tropf	MSP
10	Stephanie Marchbanks	Networks NW
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---------- Forwarded message ---------
From: **Jennifer Neal** <jennifer.neal@networksnorthwest.org>
Date: Tue, Apr 18, 2023 at 9:02 AM
Subject: Re: Leelanau County NFIP Communities
To: Christine Neiswonger <empiretownshipclerk@gmail.com>

Thank you, Christine! Your input is much appreciated.

Best regards,

Jenni

On Mon, Apr 17, 2023 at 4:31 PM Christine Neiswonger <empiretownshipclerk@gmail.com> wrote:

> Hello Jennifer,
>
> Empire Township, Leelanau County, answers to your questions are as follows:
> 1. Empire Township's Zoning Administrator
> 2. Leelanau County Construction Codes Office
> 3. Leelanau County Soil Conservation Office
>
> Please contact me with any questions.
> Thank you.
> Chris Neiswonger, Empire Township Clerk
>
> •••

On Tue, Apr 11, 2023 at 2:09 PM Jennifer Neal <jennifer.neal@networksnorthwest.org> wrote:

> Good afternoon,
>
> According to our records your community is a participating community in the National Flood Insurance Program. As part of the Leelanau County Hazard Mitigation Plan update, FEMA is asking additional questions about your NFIP participation. Could you please respond with an answer to the following questions?
>
> 1. Your implementation method: How are local floodplain management regulations implemented and enforced in Special Flood Hazard Areas?
> 2. Appointed Designee: Who is the designee or agency that is appointed to implement the addressed commitments and requirements of the NFIP?
> 3. Implementation of Damage Provisions: How do participants (your community) implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.
>
> Please do not hesitate to contact me if you have any questions. Best regards,
>
> Jenni
>
> --
> **Jennifer Neal, AICP**
> **Community Planner**
> Mobile: 231.709.3204
> jennifer.neal@networksnorthwest.org
>
> Networks Northwest
> 2240 Mitchell Park Dr., Suite B
> Petoskey MI 49770

--
Jennifer Neal, AICP
Community Planner
Mobile: 231.709.3204
jennifer.neal@networksnorthwest.org

Networks Northwest
2240 Mitchell Park Dr., Suite B
Petoskey MI 49770

Networks Northwest
Talent / Business / Community

Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Manistee County Hazard Mitigation Plan Available for Review and Comment until June 20

Audrey Menninga <amenninga@gtcd.org> Fri, Jun 30, 2023 at 8:12 AM
To: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Hi Stephanie,
I would maybe change the language for the HWA in Benzie County - at this time, due to how long we suspect this infestation at Crystal Downs has been there, it is likely that it has been spread elsewhere in the county, and it's just a matter of finding it now unfortunately. As to the priority species for each county, there's definitely some overlap, but here's what I would likely put it at:

- Manistee County: HWA, invasive knotweeds, invasive phragmites, Japanese barberry
- Benzie County: HWA, invasive knotweeds, invasive phragmites, baby's breath
- Leelanau County: HWA, invasive knotweeds, invasive phragmites, baby's breath, and coltsfoot

Manistee has some pretty dense populations of Japanese barberry, especially in Onekama where I've seen entire hillsides of it growing. Baby's breath is included for Benzie and Leelanau Counties because it grows on the dunes and beaches, which can limit recreational use of the beaches and also can threaten some federally threatened species including pitcher's thistles. Coltsfoot is a species that has been found in Leelanau County, and grows in the same areas as federally endangered Michigan monkey flower, which is a species that is endemic to Michigan. HWA is included for all three counties, due to its threat to our dense and important hemlock populations, invasive knotweeds are listed because of their potential for destruction to infrastructure, ability to spread easily, and dense growth patterns, and invasive phragmites are listed due to their habitat impacts and their ability to restrict beach use and lower property values.

If you have any questions, please let me know!

On Tue, Jun 27, 2023 at 10:17 AM Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org> wrote:
> Hello Audrey,
>
> Thanks so much for your reply! I will make the changes you mentioned accordingly in the invasive species section of the plan. And yes, if you can indicate what specific species NMISN thinks are of most concern, and maybe a short description of why and if there are specific geographic areas that are affected, that would be great.
>
> We are also wrapping up the Hazard Mitigation Plans for Benzie and Leelanau counties, so the same info. on invasive species could also be applied to those plans. We do mention that HWA has been detected in Benzie County (Crystal Downs Country Club and Sleeping Bear Dunes) but that the infestations have been contained and monitoring efforts remain in effect.
>
> No public comments or questions pertaining to invasive species were brought up in the public input sessions for any of these plans.
>
> **Stephanie Marchbanks**
> **Community Planner**
> **Networks Northwest**
>
> Desk: 231.439.5247
> Mobile: 231.590.0930
> stephanie.marchbanks@networksnorthwest.org
>
> Networks Northwest
> Talent / Business / Community
> 2240 Mitchell Park Dr., Suite B
> Petoskey MI 49770
>
> On Mon, Jun 26, 2023 at 4:10 PM Audrey Menninga <amenninga@gtcd.org> wrote:
> > Hi Stephanie,
> > I'm so sorry for how long it took me to get to this! A couple of things:
> >
> > - We actually usually abbreviate our name as NWISN, just to specify which region of Northern Lower Michigan.
> > - In 2019, we actually redid our priority invasive species and we now have the "Top 12 Species" instead of 20 - it's a little more manageable! I've attached a graphic that includes that, in case you'd like to use it. If you'd like, I can also pick out specific species that ISN believes may be of concern.
> > - For HWA, I don't know if it's worth noting that HWA is currently found to the south and north of Manistee County. It is highly suspected that there are HWA populations within Manistee County, and we just haven't found them yet.
> >
> > I think that was everything that I had - I'm happy to answer any follow up questions, or any other questions that were raised during the public session.
> >
> > On Tue, Jun 13, 2023 at 12:25 PM Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org> wrote:
> > > Dear Manistee County Stakeholder,
> > >
> > > The Manistee County Department of 911/Central Dispatch, with assistance from Networks Northwest, has prepared a draft of the County's 2023 Natural Hazard Mitigation Plan. This is a multi-jurisdictional plan which provides mitigation strategies for many hazards, such as wildfire, flooding, invasive species, and public health emergencies. The strategies consider how to mitigate the impacts of hazard events on vulnerable populations (such as the elderly, disabled, isolated, or low-income individuals), as well as personal property, the economy and infrastructure, and environmental features.
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> > > As a valued community stakeholder, your input is very important! The draft plan, mitigation strategies and maps can be viewed on the project webpage. Suggested edits and questions are welcome (please email or call me). A public hearing will be held for the plan on Tuesday, June 20, 2023 at 9:15 AM. The meeting location is in the Manistee County Board of Commissioners' Meeting Room in the Manistee County Courthouse and Government Center, at 415 Third Street, Manistee, Michigan. An option to attend virtually via Zoom is also available:
> > > https://us06web.zoom.us/j/83580115646 Password: 4153
> > >
> > > Upon review of the plan, the Board of Commissioners shall recommend it be sent to Michigan State Police Homeland Security Division for review and then on to FEMA for their review and approval. Once FEMA has approved the plan, it will be brought before the County and all local government boards for adoption later this year.
> > >
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> > Audrey Menninga (she/her)
> > Northwest Michigan Invasive Species Network
> > ISN Coordinator
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